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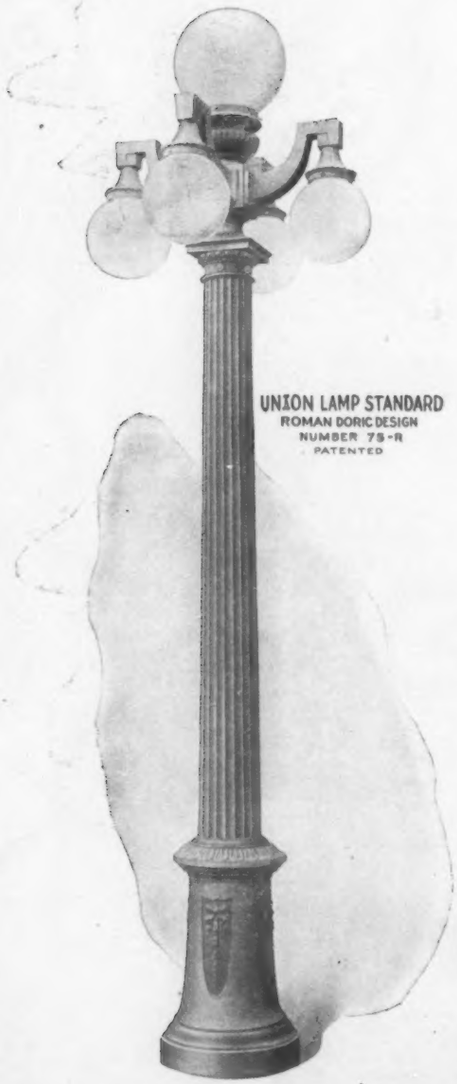

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXIX SAN FRANCISCO, OCTOBER 26, 1912 NUMBER 17

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Missoula, Montana.

ONE-MAN CAR OPERATION IN MONTANA

The operation of a prepayment car by means of one man fulfilling the duties of both motorman and conductor offers upon first consideration many possible misgivings. Before the mental vision of the busy traffic manager arise doubts as to whether accidents would not be prevalent under such a system, that rowdyism and stealing rides would thereby be made possible and even painful thoughts arise as to what might happen should the motorman, the sole operator of the car, become suddenly sick or even die. It has remained for one of the enterprising cities of western Montana to actually demonstrate the fallacy of such painful forebodings with the result that three years of trial has awakened in the community served by this system a wholesome public attitude, firm in its approval of the system, and among the employes of the company the resulting higher pay and responsible direction given to the man operating each car a well-defined esprit de corps seldom brought about elsewhere. Sydney R. Inch, general manager of the Missoula Street Railway Company, is responsible almost entirely for this efficient evolution in car design and operation. In the following lines may be found an abstract of Mr. Inch's paper recently presented before the Chicago convention of the American Electric Railway Transportation and Traffic Association, wherein this unusual accomplishment is set forth:

While the operation of one-man cars is not new, it is only within the past three years that a type of car has been developed which has made such operation free from difficulty and danger, and has not only secured economy in platform expense but has also provided adequately for the safety of the public, the collection of fares, and the maintenance of reasonably fast schedules.

Until very recently, the operation of one-man cars was limited to the smallest systems or to very unimportant feeder lines of the larger systems, where, if need be, cars could be stopped while fares were being collected, or where the company was willing to take long chances by having the motorman run the car at a slow rate of speed and then leave his controller and collect fares while the car was in motion.

The defects of the system when so operated were so many and so obvious that the use of the one-man cars fell into merited disrepute.

Recent experience, however, seems to prove that in most cities of 50,000 people or less one-man prepayment cars can be operated under the same schedules and handle the same traffic as two-man cars of the prepayment type with the positive advantages of greater freedom from accident and reduced operating expenses.

In order to secure such a result, however, it is necessary to go to the other extreme from the dilapi-

dated equipment, the poor track and the ragged overhead work which often characterized the one-man systems of the past, for the successful one-man system of today will need to be equipped with first-class rolling stock and the track and overhead work of the one-man system will have to be maintained at all times in good condition.

There are now several places where one-man prepayment cars of the general type recommended are in use, but so far as I know the first system to be designed specially for one-man operation along these lines, and to be operated continuously and exclusively as such, is the one with which I am connected, one of a number of public utility properties in Montana owned by William A. Clark.

The lines of the Missoula Street Railway were built in 1909, and the one-man car which we use was designed in April of that year. The problem which we set ourselves to solve in its design was the reduction of operating expense without any corresponding sacrifice in matters of safety and schedule. The question of operating expense was, as everyone who is familiar with the inter-mountain states will believe readily, a very serious matter indeed with us, for wages in Montana are from 50 per cent to 100 per cent higher than in either the Eastern or the Pacific Coast States, while income is based on the universal 5-cent fare and therefore is no greater than elsewhere. It was very evident that unless operating expenses could be cut materially below the ordinary figures, we could not expect to pay our way, and this meant that we must reduce to a minimum the number of men employed. This we did in two ways: first, by the elimination of the entirely unnecessary conductor, adding his duties to those of the motorman; and second, by adopting reasonably fast schedules and reducing lay-overs to a minimum in order to give good service with relatively few cars.

Double-Track Cars.

In order to maintain safety the fast schedules necessary for reasonably good service in a scattered district operated with comparatively few cars, and to do so with comfort to our passengers, we adopted double-truck cars exclusively, and equipped them all with air brakes.

City cars are double-end, thirty-two passenger Brill semi-convertible cars, 39 feet 9 inches in over-all length, mounted on maximum traction trucks, and equipped with two G. E. 210 interpole 600-volt motors.

On our interurban line, we use a single-end, fifty-two-passenger car, 46 feet in over-all length, mounted on M. C. B. trucks and equipped with four motors of the above-mentioned type. Steel wheels are used throughout, driving wheels being 33 inches in diameter. The gear ratio on all cars is 15/71.

Arrangement of Platform.

The platforms are 6 feet long and are arranged so that passengers board and alight at the same platform and at the same side of the car. The double folding vestibuled doors, together with corresponding folding steps, are operated by hand levers under the control of the motorman, and on some of the cars the bulkhead doors are controlled in a similar way. On the platform is a Brill 4A fare box. Railings are used to divide the platforms into three sections for boarding and alighting passengers and the motorman, respectively. There are no grab handles visible when the car doors are shut, and the steps fold up so as to afford no foothold; the bumpers are provided with inclined metal shields to prevent persons from riding on them and the vestibule windows are guarded to prevent people from climbing in at the rear end of the car to avoid paying their fare. The rear platform is used as a smoking compartment, the doors being locked securely.

The floor plan of our standard car, published herewith, will give a good idea of the special platform arrangement.

System of Operation.

The car is brought to a complete stop before the doors are opened, and the doors are closed before the car is started.

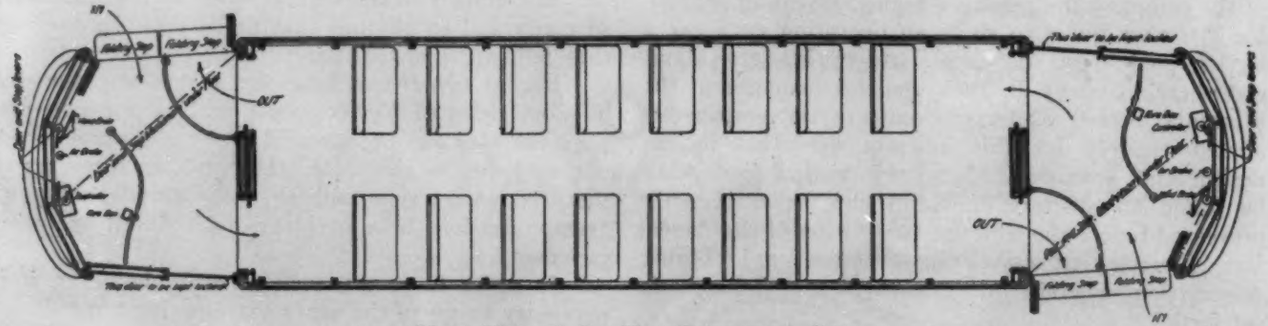
The cars stop at the near side of intersecting streets, which places the front platform opposite the sidewalk, and are not stopped to take on or discharge passengers except at street intersections.

Push buttons placed in every side post enable passengers to signal the motorman.

Fares are collected by means of a fare box, and the motorman is required to make change and issue transfers, which must be asked for when the passenger pays his fare. We have adopted a method of run rotation, so that each man's receipts are checked by the receipts of other men on the same run. The plan has worked satisfactorily, not only by permitting comparisons, but by preventing undue familiarity between motormen and regular passengers.

Schedules.

With the cars so operated and with a working day of eighteen hours, city cars make an average of 4,300 miles per month, while on the semi-interurban lines a



Floor Plan of One-Man Prepayment Car.

car makes an average of 8,800 miles per month. The schedule speed on the city lines, including lay-overs, is practically 8 m. p. h., and on one of the interurban runs is 16.4 m. p. h.

The regular headway on the city lines is fifteen minutes, but our lines are so arranged that nearly all cars pass through the center of town, where we have laid double track. This arrangement gives us a five-minute schedule for three-quarters of a mile through the down-town section.

Accidents.

It will no doubt be acknowledged that for all systems attempting fast schedules the use of cars having closed doors and folding steps is desirable. For the one-man system, the use of cars of this type may be considered essential, and, as with two-man systems, the number of platform accidents will be thereby greatly reduced.

It is, I think, fair to claim for one-man cars so equipped, and with passengers boarding and alighting at the front platform under the immediate observation of the motorman, a distinct and positive advantage for the one-man car as compared with the ordinary two-man car, for it removes the division of responsibility as to the starting of the car which has been such a frequent cause of platform accidents.

In the past two and a half years our cars have made nearly a million car-miles, practically without accident and absolutely without a single accident which could in any way be charged to one-man operation.

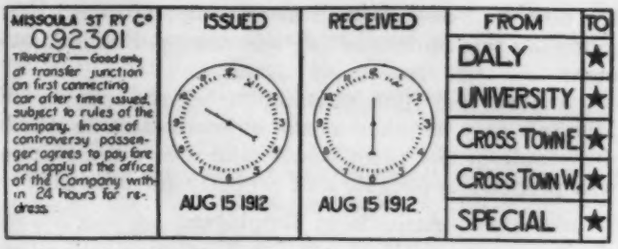
Handling Traffic.

However, the faster speeds at which closed platform cars may be operated safely makes the net delay very small even in large cities, and since the delay to one-man cars from this cause is no greater than in the case of two-man cars, it becomes altogether negligible in any place where the use of one-man cars would be feasible.

On many occasions, we have had 120 passengers on our thirty-two-passenger cars, with the car in charge of one man as usual. With most small systems, however, the handling of large standing loads is unfortunately rare and the one-man car is not recommended for places where such profitable conditions are the rule rather than the exception.

Making change and issuing transfers sometimes cause slight delay, but much less than might be thought and certainly not enough to be a serious disadvantage. While the use of tickets would be of some advantage to us as saving the delay incident to making change, we have not found delay of this kind sufficient to cause us to offer tickets for less than 5 cents straight.

The issue of transfers might be more serious, however, where the number issued is large and where the usual transfer is used. Delay from this cause can be avoided largely by the use of transfers specially prepared for the purpose. We have devised a transfer which suits our conditions very well. This is illustrated herewith.


MISSOULA ST RY C°
092301
TRANSFER — Good only at transfer junction on first connecting car after time issued, subject to rules of the company. In case of controversy passenger agrees to pay fare and apply at the office of the Company within 24 hours for redress.
ISSUED
AUG 15 1912
RECEIVED
AUG 15 1912
FROM
TO
DALY
UNIVERSITY
CROSS TOWN E.
CROSS TOWN W.
SPECIAL

One-Man Prepayment Car Transfer Form.

Other Criticisms.

It has also been suggested that with the one-man system it would be impossible to deal with rowdyism on the cars and to prevent people from stealing rides. It is our experience that the latter trouble can be prevented altogether by the proper construction of the car and, although one of our lines runs to a military post, another to a large lumber camp, and still another to a state university, we find that all these lines are served satisfactorily with one-man cars and that trouble of the kind mentioned is exceedingly rare.

Another criticism refers to the possibility of the sudden illness or death of the motorman. Exactly the same criticism applies to the operation of most interurban lines, where the motorman is so separated from the rest of the crew that they would probably not know of any such mishap to him for some time, and in a lesser degree to the operation of ordinary city cars, where it is quite possible that the conductor would not immediately know of the motorman's condition. The fact is that the possibility of such an accident is so very remote that it does not have much consideration in any surface system. However, if it was thought desirable, it would be quite feasible to develop a "dead-man's handle" for the Type K controller used commonly on city lines, and, in addition, to use automatic stopping devices in connection with signals on interurban lines.

At first we did have a good deal of trolley trouble, but it has been avoided almost entirely by putting a trolley pole at each end of the car, located immediately above the king bolt of the truck, by the use of trolley catchers, and, most important of all, by the use of Detroit type trolley frogs located very carefully and securely. We also find that the use of 6-inch high-speed, deep-groove trolley wheels throughout is of some advantage. It is now a rare occurrence for us to have a trolley leave the wire.

Attitude of the Public.

We anticipated much more trouble from this source than we actually experienced and what little we actually had was of very short duration, and has now died out altogether. The public has found that no accidents have resulted from the one-man plan, and apparently realizes too that the system has enabled us to give better and more frequent car service than we would be able to do otherwise. We have appealed to the enlightened self-interest of the public and have found by a frank discussion that the benefits of more lines and more cars which the reduction of operating expense due to the one-man plan has made possible

are now well understood in our community and that following this understanding has come public indorsement.

I feel that the satisfaction of the people of Missoula may be taken as the ultimate attitude which the people of any town would take where the system was properly applicable and properly introduced.

Attitude of Employees.

In order to gain the men's support, we appealed, as in the case of the public, to their self-interest; first, by paying a bonus of 5 cents per hour for one-man operation, and second, by so equipping the cars as to reduce the labor of running them to a minimum. The result has exceeded our expectations and now the men themselves are as enthusiastic about that one-man idea as the officers of the company could wish.

It is no doubt a fact that less prejudice on the part of the public and less antagonism on the part of the employees to departures from the ordinary method of operation are to be expected in the starting of a new street railway system, such as ours, than in making changes of a similar character on an existing system.

It is, however, easy to over-estimate this advantage, for the population of any town where a street railway would be built is composed largely of people who are familiar with ordinary methods of street car operation, and who, consequently, will view any innovations of a radical nature with a good deal of suspicion.

I think that companies now operating two-man cars that might try the operation of one-man prepayment cars would find the fact that several such systems are now in successful operation would be of greater advantage to them in attempting to introduce one-man cars than the fact that our system was installed where there had not previously been any car service was to us.

Results.

In Missoula and its surroundings, with a total population of about 17,000, the Missoula Street Railway, using one-man prepayment cars over an equivalent of 19 miles of single track during the past two and a half years under reasonably fast schedules, has operated profitably eight regular double-truck cars, carried, including interurban business, over 2,500,000 passengers, and run nearly a million car-miles without a serious accident.

Notwithstanding that carmen's wages in Montana are probably higher than anywhere else in the United States, being from 35 cents to 40 cents per hour in Missoula, according to length of service, operating expenses have been kept below 14 cents per car-mile, and it is believed can be reduced still further.

This makes an interesting comparison with the figures given in the United States census of street and electric railways in 1907, where the average operating expense for all systems having a gross income of less than $500,000 a year was shown to be 16.8 cents per car-mile. The census figures are based upon the average rate paid throughout the whole country to motormen and conductors, which is less than 70 per cent of the average rate paid in Montana. These comparisons appear to show that if in Montana one-man cars can be operated for 14 cents per car-mile, very much lower unit costs should be obtainable in places where carmen's wages are nearer the average rates.

Our annual saving, due to one-man operation, is now about $15,000 a year, and this will increase as the system grows, as it must do in a town which has trebled its population between the census of 1900 and that of 1910.

It is my belief that similar results can be obtained by any company operating in a town or city of, say, 50,000 population or less, under ordinary conditions, and that in such a case it is probable all the lines could be well served with one-man cars. It also seems probable that many of the larger systems could adopt the plan safely for suburban lines which do not go through the downtown districts.

The fact that in St. Paul and Minneapolis cars having platforms closed while in motion have been used successfully for many years may be taken to dispose of the criticism that this feature of our plan is not feasible in the comparatively small cities for which one-man cars are recommended. Reference may also be made to the instant approval which the traveling public accorded to the near-side car adopted recently in Philadelphia; this car, while used in Philadelphia as a two-man car, having the conductor stationed on the front platform with the motorman, would seem to make an excellent one-man prepayment car for places where the traffic is light. This car, in all its main operating features, seems to be very similar to the Missoula car, although the platform arrangement and general construction of the Philadelphia near-side car are quite different from the Missoula car.

Considered together with the excellent results obtained by other systems using one-man cars, the success of the Missoula car would seem to go far in support of my contention that in most towns and cities of comparatively small size the use of cars operated as described will make the employment of conductors an unnecessary expense offering no compensating advantages.

GOOD ROAD MEASURES FOR OREGON.

Recommendations that three of the "harmony" road bills proposed by initiative at the coming election be voted for and that the bills prepared by the state grange committee be voted against was passed recently by the Oregon Society of Engineers at a business session following its quarterly dinner at the Imperial Hotel. The action was taken after a special committee composed of T. M. Hurlburt, city engineer of Portland; W. P. Hardesty of the city engineer's office, and O. Laurgaard, a leading irrigation project engineer, had made an extensive study of all the road bills submitted to the judgment of the people and filed its report. Great interest is being manifested in this matter by all Oregon engineers. Frank B. Riley, state vice-president of the Pacific Highway Association, has addressed several meetings of engineers and it is hoped that this campaign will result in a magnificent system of roads for the state.

USE OF ELECTRIC POWER FOR IRRIGATION AND OTHER RURAL PURPOSES.

BY GEORGE C. ARROWSMITH.

(Concluded.)

In different localities different quantities of water are required on account of the difference in soils; and although at present the loose sandy soils appear to require more water than the clayey soils, I believe that methods of irrigation will be worked out so that the sandy soils will take less water than the clayey, and think that very early spring watering will be a great saver of summer water by reason of the fact that water is drawn back to the surface by capillary attraction more in the sandy soil, resulting in the use of power before and after the real season.

This may not—and does not—hold good on newly planted land as the extreme surface dries up so quickly that new crops, having such shallow roots, require more frequent application and hence more water. This sometimes calls for the installation of larger plants than is necessary, but in the majority of cases is taken care of automatically. For instance: A customer has 80 acres of land and purchases a plant to furnish 30 acre inches thereon every season. He cultivates 40 acres and perhaps uses his entire plant delivering 60 inches on the 40 acres for the first season; but after the first season the 40 acres will take less water and he cultivates, say, another 20, using the entire plant for this, and so on until he is using the plant to deliver 30 acre inches on the whole 80, as originally intended, which enables him to purchase a plant of the right size in the first place but costs him more for power per acre for the first few seasons.

Testing Apparatus.

The testing of apparatus, both for input of power and output of water, should be carefully attended to, for the power companies' sake and for the protection of the customer, and other data such as the capacity of apparatus, number of acres cultivated, etc., kept of record for ready reference. The testing of apparatus in isolated districts, and especially where apparatus has not been right has been a source of tremendous expense to power companies, in that repeated visits have had to be made, but with the standardization of apparatus this expense will be brought to a minimum.

Relative Costs Electric Power, Gravity, Gasoline, Distillates, Steam, Etc.

From sources of water supply that have not already been appropriated or apportioned so that the irrigator does not have to purchase a water right, the use of electric power and pumping machinery in independent units possesses great advantages over irrigation by gravity canal or by large pumping units where water rights have to be purchased at high cost and maintenance paid, in that the first cost of pumping machinery comes to far less per acre than the purchase of a water right, the interest on which water right alone is more than the interest, depreciation, maintenance and power, of an electric unit. Also the maintenance charge on the gravity supply is subject to change, according to the cost of operating and maintaining the canal, which may be altered considerably, whereas the power charge must remain the same. Take for example the following:

Irrigation by Gravity.

Cost of water right, $100.00 per acre, making at 8% simple interest forever a fixed charge per acre	$ 8.00
Usual maintenance charge from average of a number of canals	2.10
Total cost per acre year on average canal	$10.10

By Electric Power.

(10 H.P. plant, 50 ft. head, delivering same water duty as gravity canal.)

Cost of plant complete, with well, etc., for irrigating 122 acres, $825.00, or per acre cost of $6.75—Interest at 8% on $6.75	$0.54
Depreciation at 12% on $6.75	.81
Maintenance of machinery, 10%	.67
Power bill per acre	3.29
	$5.31

Making a difference in the favor of the pumping system of $4.79 per acre season which, from a monetary standpoint alone, will enable the land owner to pump the same amount of water that the gravity canal will supply him, to an elevation of 100 feet, at the same cost of gravity water.

Also independent pumping enables him to pump water earlier or later in the season than delivered by gravity canals, which is often considerable advantage; puts land under irrigation that is inaccessible to gravity canals, and puts all independent of any general irrigation scheme.

At present there are a great number of gasoline engines throughout the country pumping water, and successful results have been obtained thereby; and these outfits are not to be generally belittled, but the electric power should—and will—supersede these entirely, as lines are extended and the reliability of electric power becomes thoroughly known. Ease of operation, reliability, and cost of operation go a long way towards boosting the sale of electric power and apparatus, as against the use of gasoline or distillate power, and though electric power has so many general advantages on its side, still, at the same time, there are conditions existing right under power companies' lines that are, owing to the fixed charges necessary to electric service, hard to meet in competition with gasoline and distillate, as will be seen from the accompanying comparative duty curve of electric, gasoline and distillate powers.

From this daily curve, which is purely a current cost as against fuel cost, eliminating all other charges attendant on the use of gasoline, such as repairs, oil, batteries, not to mention "bad language," it will be seen that for daily use throughout the season, or at any time during the month that goes to make a load factor of approximately 16½ per cent, the fuel cost of gasoline and current cost per horsepower hour are the same, and at a load factor of approximately 32 per cent the fuel costs of distillates and current costs per horsepower hour are the same. However, these fuel consumption figures are generally laboratory tests, or at least what are obtained when apparatus is new and under skillful operation, and are very rarely obtained in actual practice and allowances can safely be made to increase the fuel consumption of gasoline and distillates 20 per cent.

In the irrigation of land, especially small tracts, there are many irrigators who install a comparatively

large unit and who use the same on a season load factor of as low as 7 per cent which makes it difficult to contract for power, especially when the irrigator already has his own plant installed and paid for. I think that power companies might do well to get in touch with some second hand dealers who would be willing to purchase these outfits at a reasonable price, which would result in the substitution of electric power for gasoline in many instances.

The vagaries, and the trouble and expense of operating gasoline engines, particularly by unskilled hands, are so well known that it would be superfluous to enter into the subject here, still, their ability to compete with electric power should not be underestimated.

There have been quite a few producer plants installed but, owing to the grade of coal obtainable in the Northwest, the high installation, maintenance, and labor costs they cannot compete with electric power and have been displaced in every instance.

The Diesel engine being comparatively new, and the cost of installation and attendance for small units being so high, need not be considered; but for large units may become a keen competititor of electric power.

As the production of steam power by fuel oil or coal is necessarily confined to large installations, and the conditions governing the cost of production so varied, and estimates so extensive, a discussion of the relative costs here would take too much space; but it should not be difficult for any power company to obtain a large contract for power on a profitable basis as against steam, especially on new installations.

The Power Contract.

The power contract should be made for ten years or as short as five years, as condensed as possible, and owing to the fact that power companies must be consistent, all customers should of course be treated alike; should be so arranged that the power bill will constitute a lien on the property, just the same as any water right, and think that the lien on the property is enough to secure the company from loss; and being that this is the case and is generally a "bugbear" to the customer, yet is easily explained to him. It is superfluous and only aggravating to have the contract constitute a lien on the pumping apparatus also, and as the lien on the real property is already sufficient, it is hard to make it appear consistent to a customer. And, finally, the contract should be made as little one-sided as is consistent with good business and fairness purely as a public utility corporation.

The Contract Agent or Solicitor for the Power Co.

The contract agent for the power company (whether or not the company furnishes apparatus) should be a man who is technically able to correctly estimate anything pertaining to the following:

Prime Mover Electric Power.

Prime Mover Steam or Oil Power.

Prime Mover Gasoline or Distillate.

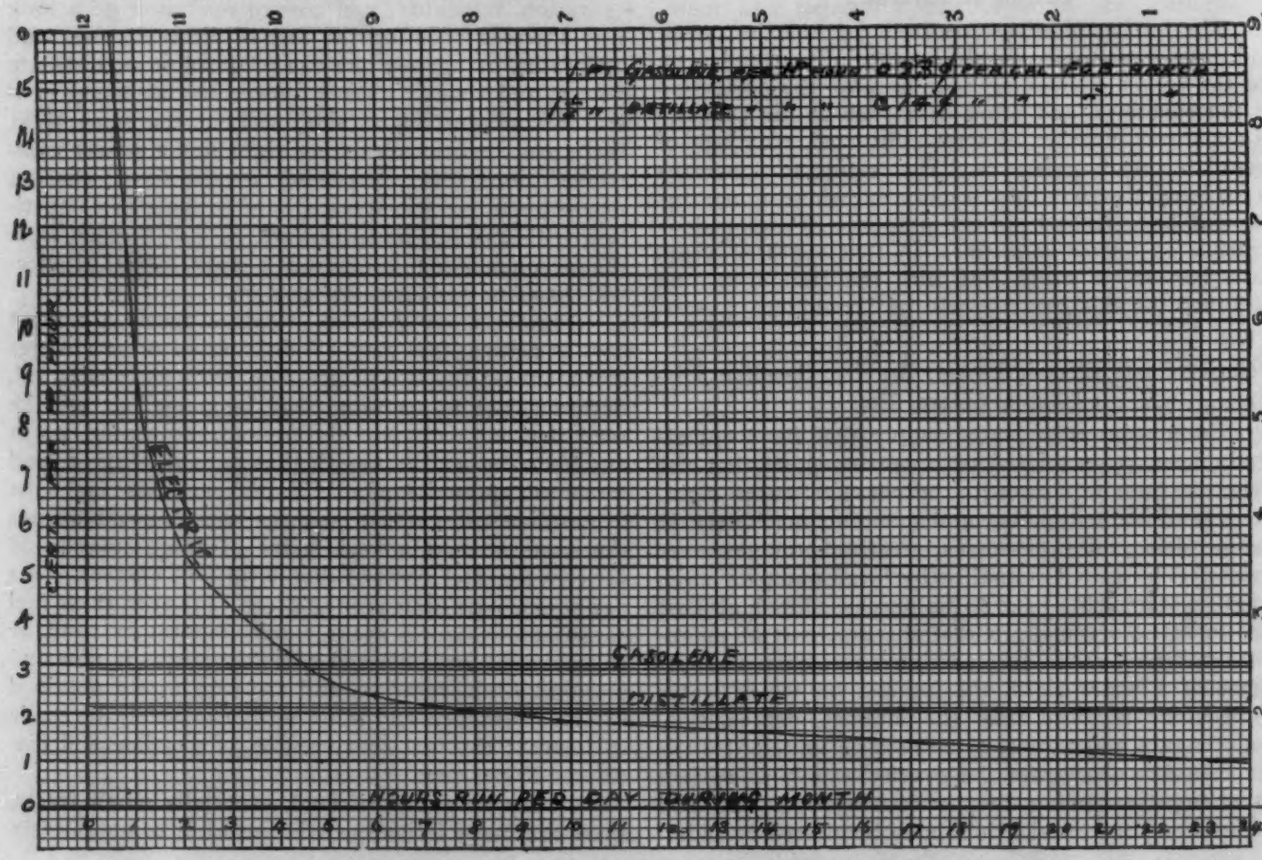
Prime Mover Water Power and General Hydraulics.

Pumps—Amount of power required.

Efficiency.

Appurtenances.

Class of installation best suited to customer.



Curve Showing Comparative Duty of Electric, Gasoline and Distillate Power.

Water—Pipe lines for supply or distribution.
Best methods to obtain from supply.
Amount of water duty for different soils and crops.
Ditches and pipe laterals.
General usage.

In short, would be a "special" man in the irrigation business, as there is no telling at what moment, in the field and without technical aid, he may be called upon to answer questions pertaining to the foregoing; and on his ability to answer questions may depend the securing of a power contract, either in competition with other forms of power or not; and it should be the duty of the power company to examine the contract agent as to his capability of filling such a position unaided in the field so that any statements he may make may, upon question, be substantiated. His personality should be such that he establishes confidence between himself and the customer, and having secured such confidence he should be sure not to abuse it; and should any question arise as to the truth or consistency of his statements it should be thoroughly investigated by the company, and if found correct the company should back him to the "limit." And any misstatements—either by accident or design—should be treated accordingly, as upon the ability and veracity of the agent depends a great deal of the power company's success in the irrigation field.

Advertising.

As heretofore in this treatise stated, there are a great many installations in operation that, owing to inefficiency and poor design, are not very good advertising for the power companies, and think there could be no cheaper way of advertising than to see that the apparatus is right; and should this be done, do not think any expense should be incurred in general advertising as a satisfied customer is the kind of advertising that talks. The power companies, to hasten this happy result, should supply its agent with one working example of the highest class in each district covered by him.

General Utility, Power, and Effect on General Health, Etc.

Up to date, being that in the Pacific Northwest the supplying of irrigation power is comparatively new, there is not much power being used on the farm for other than irrigation purposes; and while the effect of added cultivated area has somewhat increased the general commercial light and power loads, the extent of this effect is not known but is surely there.

The possibilities for the use of power on the farm in the arid regions are greater than any other and will develop to a large degree as soon as the customer gets the irrigation end right, and becomes more accustomed to the uses of power, and believe that current will be generally used for supplying domestic and stock water, grinding alfalfa, sawing wood, spraying trees, and of course lighting. And here again electricity plays an important part in serving mankind, in that it will put the farmer on the same plane of modern domestic conveniences as his city brother. The statistics gathered by the United States go to show that the chief drawback in farm life—especially for the housewife—is the lack of running water and modern sanitary conveniences, which drawback is eliminated by having power, which takes the place of the city water main. And as such sanitary conveniences are installed, so will the general health of a district be improved, to say nothing of the lessening of the household burden.

This brings up a discussion as to the installation of direct connected units as against belt connected, which would require considerable space to treat fully; yet as the supply of water for irrigation and domestic purposes is most important and of all year demand, and the efficiency of the direct connected unit is some 10 or 15 per cent greater than the belted, and irrigation constitutes by far the largest percentage of the total yearly consumption, would hold for a direct connected unit, which also has other operation and maintenance charges. However, different conditions should be thoroughly considered by and between the power agent and the customer.

In irrigated districts water supplied from shallow wells is subject to pollution from seepage and drainage; and here again the power company might do a good deed for the community by invoking the aid of the State Health Department and have them extend its field of usefulness and establish rules for right sanitation in such districts which, while the immediate necessity may not appear to be wanting, yet as districts become more populated will be a matter of necessity, and from such action during the development of a district a lasting benefit result, and indirectly work to the advantage of the power company, because there is nothing that will hold back a district and keep money out of it, like flies, filth and fever, the fame (?) of which, while generally originating in the country districts is, by the outside world, accredited to nearby towns with derogatory results that again work, undeservedly, against the power companies.

Existing Loads and Future Business.

Although, as heretofore stated, there is but a comparatively small amount of power being used for irrigation purposes, it is only comparative on account of the vast amount of this class of business that is awaiting development on lines that will prove satisfactory to the power companies upon right exploitation, and to give an idea of the magnitude of the opportunity, would say that a conservative estimate of the power required to irrigate land in Yakima, Benton, Walla Walla, Franklin, Grant, Douglas and Chelan Counties alone of the State of Washington amounts to not less than 90,000 horsepower, the supply of water necessarily, in every case, being immediately available, and predict that this amount of power will be in operation within the next ten years.

Again, the counties mentioned comprise only a small portion of the total area available in the State of Washington, to say nothing of the vast areas in Oregon and Idaho, and the effect on the general prosperity of these states by the utilizing of such an enormous amount of power will be tremendous, especially to the commercial and lighting loads of the power companies.

HYDROELECTRIC POWER PLANTS IN CALIFORNIA.

Discussion of paper by J. D. Galloway presented before San Francisco Section of the American Institute of Electrical Engineers, September 27, 1912, and published in these columns October 12, 1912. The following participated in the discussion:

A. H. Halloran, Chairman.
Geo. J. Henry, Jr., consulting engineer.
H. Homberger, consulting engineer.
S. L. Berry, consulting engineer.
C. L. Cory, consulting engineer.
P. T. Hanscom, general superintendent Great Western Power Company.
J. D. Galloway, consulting engineer.

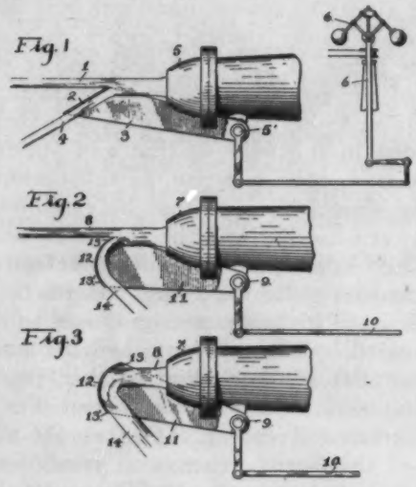
Chairman: We have all enjoyed this interesting and instructive paper of Mr. Galloway's. There are a number of points developed in the paper which are worthy of discussion, perhaps, first from the historical side, and later from the point of view of the various recommendations which Mr. Galloway's experience has shown are justifiable, particularly the mooted question of riveted pipe versus lap-welded. We have with us this evening several who have been pioneers in the development of hydroelectric practice on the coast, among whom is Mr. George J. Henry, who will open the discussion.

Geo. J. Henry, Jr.: I would be glad to shed any light I can on the subject that Mr. Galloway has so ably handled, but I would like to enter into the discussion later when I have heard some of the gentlemen who are more vitally concerned with the use of the apparatus. My experience has been more in the design of hydraulic equipment, and I am always very glad and feel that I get the best possible information to help me in my work from engineers who put the plants in and operators of the plants.

Mr. Galloway during the last few moments here mentioned the by-pass nozzle as a recent outgrowth. It has come into prominence in recent years; but my first knowledge of it was in connection with the proposals for the Nexaca plant in Mexico, the order for which was placed in 1901 or 1902 in New York. I was in New York at that time in connection with the designing of that plant and the proposals that my company put in; and we designed and recommended for their use the by-pass nozzle. The European makers, Escher Wyss, also designed and recommended a by-pass nozzle for use at that time. They used the rectangular form of nozzle; that is, it has a rectangular outlet, and, of course, they furnished a tangential wheel bucket corresponding to this stream shape. The Necaxa plant was built and equipped with by-pass nozzles.

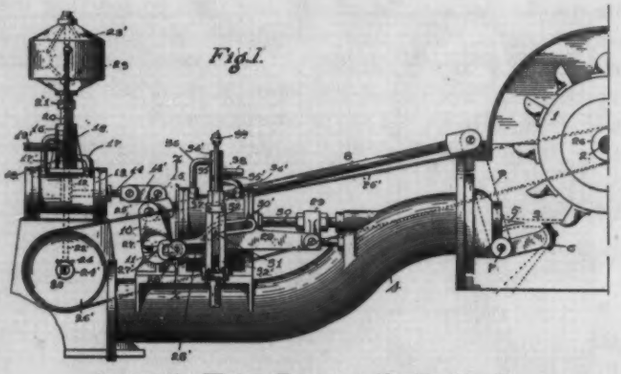
The next step was the Animas plant in Colorado. My company built and installed by-pass nozzles in that plant. The nozzle shortly afterwards jumped into prominence and has been used ever since.

There is, however, a further development in nozzle design, and I have put in several nozzles of a more complicated construction than the by-pass form and in some cases more expensive to install. The reason we went to further complication and expense was to eliminate water hammer or increased pressure that does occur in using the by-pass form of nozzle. There is no doubt but that the by-pass form of nozzle as frequently used today, in which you have a needle actuated by a governor directly connected through the dash pot with a secondary needle actuated in a reverse direction and slowly closing, is all right on short pipe lines; but when the pipe line is several thousand feet or more, as is so frequently the case, the by-pass form of nozzle begins to cause pressure waves, which are disastrous to good regulation. Especially on long pipe lines has this been the experience. We got up a form of nozzle, however, to give automatic and perfect regulation with any length of pipe line, and at the same time to effect the greatest possible water economy. To get accurate speed regulation you must quickly throw off or on your full jet of water from or to the buckets of the wheel; and I think it is generally conceded you must do that in from a second to two seconds of time. When dealing with large units, to throw four or five or six thousand horsepower off or on to the buckets of a water wheel in a second or two seconds' time means rapid work on the part of the governor, and, if you use a by-pass form of nozzle, extremely rapid fluctuations of the needle, and disastrous pressure waves.



Counterbalanced Stream Deflector.

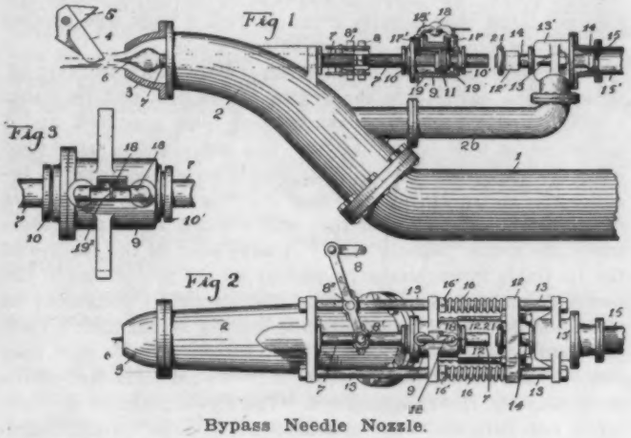
The counterbalanced stream deflector is shown in Patent Office drawing No. 853,787 herewith. The automatic water economy needle nozzle is shown in Patent Office drawing No. 993,064, and the automatic form of by-pass nozz'e is shown in Patent Office drawing No. 853,786.



Automatic Water Economy Needle Nozzle.

In installations representing a considerable amount of power under a high water pressure, the problem of accurate regulation with maximum water economy demands, I believe, the introduction of two generic principles. The quick shifting of energy off or on to the wheel as explained above is absolutely essential. Equally important with this is that the water column shall be retarded at a very slow rate. This I believe imposes the necessity of two co-acting devices, one that will take care of the quick reduction of energy from the buckets of the water wheel and the other that will slowly thereafter retard the water column until just sufficient water is flowing to give the energy output being demanded from the wheel, and the co-action of these two devices must, when more energy is demanded from the wheel, be such that the needle or other water supply regulating device will open at a very rapid rate. In other words, if the needle is in a more or less closed position, and an

increased load comes upon our wheel, we will open the needle quickly to catch the load, and the automatic nozzle (Patent Office drawing No. 993,064) is designed to accomplish this purpose. If the load goes off, e. g., the circuit breaker opening, or is reduced, the stream deflector will come instantly into the stream, and when any water is being deflected by this stream deflector, the needle will slowly close at a rate under the control of the station operator and predetermined and fixed once for all, and at a rate which will take into account the length of the pipe line, head and safety factor of the pipe, so that the pressure rise cannot exceed this predetermined amount. A number of these automatic nozzles



Bypass Needle Nozzle.

are in successful operation and have been thoroughly proved out in practice, one of them, for over four years with a head of 1,060 feet, and a pipe line of 6,000 feet, the pressure rise being less than 5 per cent. The governor makes its stroke in one and a half seconds from full off to full on or from full on to full off.

Now this apparatus will accomplish results that I do not believe can be accomplished with the by-pass form of nozzle, and will secure more accurate speed regulation and with much greater pipe safety. It is being installed by the Sierras Construction Company, after an extensive experience with both forms. This is in their new large plant for supplying the Los Angeles district over the longest transmission line in the world. I merely mention it tonight as a further step, that Mr. Galloway did not bring out.

The needle nozzle is a very old device. The first that I am familiar with was put in in the old Con. Virginia shaft in 1888; four of them were built at that time, and operated under some 1,600 head or more very successfully.

As regards lapwelded pipe, I differ with Mr. Galloway. I believe it will be found on investigation that lapwelded pipes are highly successful where they are properly designed and built, and this of course applies to all mechanical apparatus. If it is not properly designed and built, you will not get good results from it; and you cannot buy that kind of pipe indiscriminately any more than you can buy riveted pipe indiscriminately. Mr. Galloway has mentioned some riveted pipes that are very old, and probably we would find that safety factors were used on those old miners' pipes of not more than two or three. I have seen a good many broken riveted pipes. I am not an enemy of riveted pipes; neither am I a staunch advocate of lapwelded pipes, but I believe that each pipe has its particular field, and there are many cases where lapwelded pipe will be found to be safer, more economical as a conduit, to say nothing of lower first cost. The Big Creek plants are putting in lapwelded pipes for 1,680 feet in one station and 1,960 feet in the other station. The pipes at the bottom of the hill in the power house will be 24 inches up to each nozzle; will have a thickness of 1.42 inches lapwelded longitudinal joints with flanges welded on. I have in mind a rather disastrous experience over in Colorado recently with a plant in which a riveted pipe was used under high pressure. There is a point, a dividing line, below which I think it will be found very much more advantageous to use lapwelded pipe. At Big Creek that point has been determined to be quite a long way up the hill; in fact, they are going to commence with 42-inch pipe, three-eighths of an inch thick as lapweld, with double bump joints and go down the hill to a flanged line under the higher pressure.

It might be interesting for you to know how this pipe is made. The sheet is rolled up just as the sheet for a

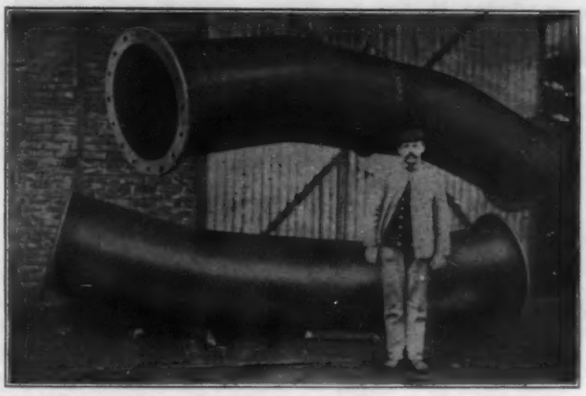


Fig. 1. One of the Special Elbows of the Lighter Material.

riveted pipe would be rolled up; then it is welded together longitudinally with a welding piece between the bevel edges

Fig. 2. Double Riveted, Double Hump Joint.

of the plate making a butt weld. The flange in the first place is rolled up like a locomotive tire, a piece is set in between the welded pipe and flange and welded down, then it is all

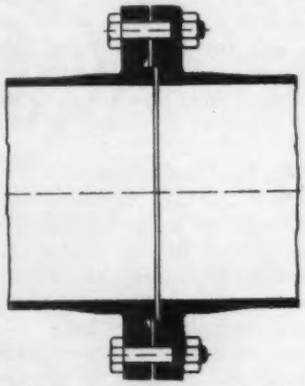


Fig. 3. Welded on Flanges and Form of Joint on the Straight Pipe.

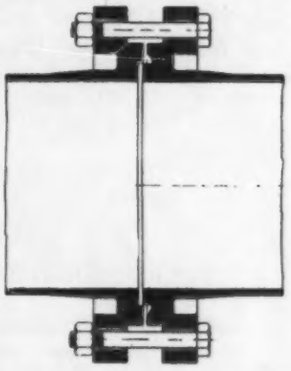


Fig. 4. Loose Flanges and Welded on Borders Used on Specials and Elbows.

put in a lathe and finished off, so you have a finished machine job on the ends of the pipe. The pipe will be made up complete and put together, every rivet hole reamed and every piece stamped where the sections go together, so it will come together just like a finished machine. They use water gas for the welding process and the large and light thicknesses are hand welded, and the intermediate thicknesses are machine welded. Each section will be fully tested in the works to a pressure considerably above the static

pressure when in place, and the elbows, wyes and specials will all be of lapwelded material, no cast steel iron or bronze fittings being used.

J. Homberger: Mr. Galloway stated that he had only five days to prepare this paper, but I have received his manuscript so late that I have had only about five minutes to prepare a discussion. Before I go to water wheels I want to refer to some other points. In speaking of flumes and ditches, Mr. Galloway mentioned that many of the existing hydroelectric plants had incorporated into their systems the ditches and flumes already in existence. In a great many instances it was an unfortunate thing that they did so. The slope allowed by the old miners, because they wanted to make the ditch small to save expense, was, as a rule, very much greater than should be allowed for power plants; I have had some cases where I recommended people that had purchased rights from old mining ditch companies to abandon the existing ditch and make an entirely new one with slighter grade—making a more economical installation. It would cost more money, but give a higher head and more power.

On flumes, Mr. Galloway says the flume is a temporary expedient, and as timber grows more costly will disappear. I suppose Mr. Galloway meant the wooden flume is a temporary expedient. No mention was made of steel flumes and concrete flumes which have been recently used extensively, and I think in some cases are very desirable.

Under the heading, "Pipes," Mr. Galloway gives the ratio between head and length of conduit. I believe this might be misunderstood. When you said the ratio is 2.32, and so forth, does not this include the canal?

J. D. Galloway: The ratio given expresses the relation between the head or drop and the length of conduit which brings the water to the pipe line; the flumes or ditches. It is a rough statement of the grade and the stream—the conduit as compared with the total drop.

H. Homberger: Mr. Henry has already spoken about welded vs. riveted pipe. Even where either may be used, I am a strong advocate of welded pipe. I made a special trip to Germany six years ago and visited the six largest plants then operating, to see how such pipe was made. One of the most interesting points is that these people will test with a specified pressure every length of pipe before it leaves the shop. This is not done with a riveted pipe. One case where I specified the pipes for a plant that was built in India I had the makers of riveted pipe put in an additional price for testing each length, and the cost of doing this testing was entirely out of the way. I think it was $25 per section of pipe. The people making welded pipe are equipped to do this testing, and do it as a matter of course, without extra charge.

Arthur Adams' formula for the most economical size pipe has been touched upon. I believe this was calculated for water works practice, where conditions are somewhat different from power-plant practice. The question of size of pipe and loss of head is an entirely economical or financial one, simply comparing how much the power is worth which you waste by making your pipe smaller and sacrificing more head.

To the same category belongs the question as to whether pipes should be designed for peak load demands or average load demands. Of course, the load factor is an important item in that; I have visited one plant in California where the pipe line had been designed apparently for a very low load factor; and the condition was such that when the gates are fully opened under a peak load, as they should be, the output is considerably less than when the gates are partially opened. The history of most hydro-electric plants has been that under peak load all units have to be loaded to utmost capacity.

Under "Gate Valves" Mr. Galloway states they should be of cast steel. I think that cannot be generalized. The size of the gate valve has a great deal to do with that, not only the head. You may use cast iron under very high head and it will give very satisfactory service, providing it is a good quality of cast iron, and not the cast iron which Mr. Galloway mentioned, where an old bolt head was found in the disk that had not melted. This was apparently largely made of scrap steel. It should be good material. I should like to know if that gate valve at Bishop, which was mentioned later in the paper, which broke under 1100 feet head, was cast iron or steel?

J. D. Galloway: It was cast iron.

H. Homberger: That is rather a high head for a big size valve to be made of cast iron. Mr. Henry has already dwelt on the by-pass nozzle. Before coming to that I will refer to another point. The impulse wheel is attributed to California. I do not think that is quite true. In 1742 a book was printed showing its use in the old Dauphinee wheel.

The deflecting nozzle I have never been much in favor of. When I was engaged in the design of the first two De Sabla wheels in 1902, deflecting nozzles had been specified, and I suggested at that time that they had some undesirable features, for instance, the packing; they are not economical because the entire saving of water depends on the carefulness of the attendants, whether they will actually move the needle when the nozzle deflects. As you have seen in the picture of the De Sabla Powerhouse, frequently all the jets go out of the powerhouse into the tailrace at full swing. I suggested at that time the use of a synchronous by-pass arrangement; such had been used in connection with turbines in Europe long ago—I think several years before they were used in the Nexaca plant that Mr. Henry mentioned. The Kubel plant, in Switzerland, has turbines with synchronous by-pass directly operated by the governor.

G. J. Henry, Jr.: That is correct, except they are not quite the same thing as the by-pass nozzle. They are synchronously operated devices, separate and distinct from nozzles.

H. Homberger: I simply wanted to say that this idea had been used in turbines.

Mention is made of the number of nozzles to one wheel. Mr. Galloway says: "As more power was required two and three nozzles were placed on one wheel. This was about the limit of the number of nozzles." If I remember correctly the Nexaca plant has four nozzles to the wheel.

Multiplicity of nozzles on one runner does not tend to good efficiency. A single nozzle wheel is more efficient than a two-nozzle wheel, and so on. I had an opportunity to test a plant years ago, where there are two machines absolutely identical in general design, except one has double the output of the other. One machine is operated with single nozzles and the other with duplex nozzles. I found a difference of about five per cent in efficiency practically all over the line in favor of the single nozzle machine.

In the early days of the tangential water wheel construction people were afraid of large jets. When the first Electra wheels were built it was decided to put two wheels alongside of each other, and they had three-inch jets. In the De Sabla plant, built much later than Electra, the first two machines are of the same output, but have single jets, and I suppose the efficiency is at least as good. There is no question but that a machine with two runners and two nozzles and so forth is an unnecessary complication if you can get the same result with one.

Mr. Galloway says that 6½ inches is the largest jet diameter. The "South Power-House" of the Northern California Power Company, I believe, has 9¼-inch jets, and that has been running now for five years.

J. D. Galloway: What is the size of the unit?

H. Homberger: Three thousand six hundred kilowatts.

J. D. Galloway: When I used the word, "largest," I meant the jet operating the same amount of power output at the wheel. I did not mean the actual diameter.

H. Homberger: The machines for the Los Angeles aqueduct are equipped with 14,000 h.p. in two wheels, each

with an 8½-inch jet. I discussed with Mr. Galloway some time ago the question of the advantage of having two wheels on one machine; he referred to a test made by Mr. Baum which indicated a higher efficiency for a two-wheel unit when each wheel carried half the load, than when one wheel carried the full load. Tangential wheels like Francis turbines are usually designed to give highest efficiency at a certain point, which point is not the maximum output of the machine. It is generally at three-quarters of the maximum the machine will carry. Now if you have a machine that has two wheels, as happened with the wheel built in 1904 for Electra—an extraordinary case—where each wheel has the full overload capacity of the generator, and you run both jets simultaneously, and run at or near the most efficient point, naturally you get a higher efficiency than you would get if you run one wheel at maximum output. I do not believe that the size of the jet has anything to do with the efficiency; that, is if I understood correctly what Mr. Galloway meant. I may have misunderstood him. If the proportion between the size of the bucket and the jet is proper there are no technical limits to that.

Geo. J. Henry, Jr.: That is my understanding within certain limitations.

H. Homberger: We have reached 10-inch jets, I think, in estimates—I think even 11-inch jets.

With regard to the question of the border line where impulse wheels and turbines clash, or are supposed to clash, it is simply a question of the quantity of water that has to be handled. The head has really nothing to do with it. If the quantity of water is sufficiently great, you may go to a very much higher head than at Centerville with Francis turbines and still get good efficiency. The turning speed conditions have very much to do with that. An impulse wheel might call for too big a generator. On the other hand, if you go too high a head with the Francis turbine and want a slow speed for the sake of the electrical end of the unit, your passages in the turbine runner will become so small that they will wear out quickly and may easily become clogged. Then the advantage is again on the side of the impulse wheel. Furthermore, there are cases where the water is very bad. If there is a lot of detritus coming in the water and cannot be kept out, the impulse wheel will suffer less than the turbine.

Regarding the 36,000 h.p. wheel proposed for the Big Bend power plant; Mr. Galloway says it was unfortunate that the Easterners were too timid to try it. The size of the unit is largely governed by operating conditions and load conditions, and by the possibility of loss of income by shutdown of the machine. Now if you have a power plant with, say, four units of 25,000 kilowatts each, and one of those units goes out for some reason or other, it would be very much more serious to the power company than if they had eight units of 12,500 each, and lost one. The question of loss of income in case of a shut-down has probably more to do with it than anything else.

Comparing the efficiency between turbines and impulse wheels, Mr. Galloway states that the efficiency of large units of turbines is between 87 and 90 per cent, and impulse wheels between 78 and 82 per cent. My personal experience in that matter from tests I have made, and a great many reports of tests I have seen, is, that the turbine efficiencies are given a little bit too high and the impulse wheel efficiency too low. They come very close together. I do not think the difference is so great.

The Chairman: Mr. S. L. Berry has had considerable experience in the design of water wheels and may be able to add some information.

S. L. Berry: In connection with this very interesting and instructive paper on "Hydroelectric Development," by Mr. Galloway, it might be well to add to the historical feature the fact that governor operated by-pass valves were used on this Coast as early as 1896 in conjunction with Girard water wheels. The Sessions-Van Emon shaft governor used at that time was so far ahead of water wheel governor practice that some unexpected difficulties were encountered on account of the severe water hammer produced by the rapid action of the mechanism. This was completely overcome by the use of large plug valves moved by the governor in inverse direction to the nozzles which were of rectangular form and made to contract by moving one wall. This device was first installed on a small wheel used on the American river, and was later utilized in a plant on the Kern river near Bakersfield. The Girard wheels did not prove successful but the governing was a distinct advance over previous practice.

Mr. Chairman: Mr. Cory, can you contribute anything to the discussion this evening?

C. L. Cory: I can only express my great appreciation to Mr. Galloway for the delightful way in which he has sketched the development of the hydroelectric plants on the Pacific Coast. As I listened to him read from his paper, and saw some of the pictures on the screen, I could not help but think of the men who had to do with the development of this great industry, not only in California and on the Pacific Coast but in America.

Some of us today, perhaps, looking at these plants may, unless we are rather thoughtful, conclude perhaps that things were not done as economically, or units chosen of the proper magnitude compared with that which exists today; but if you will bear in mind that these old miners' ditches were found here, and that the enterprise of generating electricity from water power and transmitting it and finding a market for it was a hazardous one, especially in those days, we can appreciate why these plants that were built, as Mr. Galloway has said, during the past twenty years are not exactly the type of plants that are being built today. I cannot refrain from mentioning a few names, and these names are not all the names of engineers. It wasn't an easy thing in 1892, and even as late as 1901 and 1902, to get the money necessary to build these plants; and as I looked at the large Electra plant I could not help remembering the work not of the engineer, but the enthusiasm and imagination of Prince Poniatowsky,—the detailed work of Mr. Eckart. Then again I thought of the fact that this great engine of usefulness, the hydroelectric plant, has been made up by dovetailing the work of a great many people, and it is not difficult to place certain laurels in certain places. For a long time we did not know very much about the velocity of water in various kinds of conduits. I remember very well it was Jimmy Wise who first studied most critically the uniform lines of velocity in ditches. So I might mention a number of other men—Mr. Martin, Mr. De Sabla, and many engineers of the manufacturing companies, both hydraulic and electric; and the story, to be complete, must conclude with the statement that resourcefulness and consistent effort are what has brought all these things about; the co-operation of many men occupying different relations.

The Chairman: Is there any further discussion of this paper?

Question: Are there any electrical engineers present who have any experience in the operation of plants where nozzles have been installed provided with deflectors such as Mr. Henry has described to us? I would like to know if they have had any trouble with the alternators due to the rapid throwing on or off the jet? It may be very desirable to eliminate surges in the pipe line, but if it results in creating surges in the transmission line we are not very much better off. To my mind it looks far more desirable from the transmission line point of view to have a regulation where the jet was gradually thrown off, and I would like to hear if any engineer has any experience in that?

C. L. Cory: I have had quite a little experience with generators of that type, that is, with the deflectors, and I have

never seen a single instance where there was any difficulty whatsoever from taking all of the load off the generators installed by throwing those deflectors in, even where the generators were operating in parallel with a great many others. I do not believe that the difficulty is to be compared at all with the difficulty of operating generators together when driving through a reciprocating engine.

The Chairman: Mr. Hanscom, can you contribute regarding Colorado practice as contrasted with what Mr. Galloway has brought out?

P. T. Hanscom: I might mention the Boulder Development of the Central Colorado Power Company as representing perhaps one of the most modern designs of tangential wheels. Two wheels are installed, each having a capacity of 11,000 h.p. The speed is 400 revolutions per minute, and the static head is 1,870 feet. The style of nozzle and the design of buckets are a little different from former practice. The nozzle is hung on a trunnion, and water is taken in through a bifurcated pipe to the nozzle rather than the old style ball socket joint with packing. This form of construction gives a stuffing box joint, which is more reliable than the strap packing or what is ordinarily used on the socket joint. The buckets are all cast together in one piece.

Mr. Galloway spoke of the twilight zone in choice between Francis turbines and tangential wheels. Different engineers have considered this from various extremes, perhaps one of which is the plant in British Columbia which he mentioned, where four impulse wheels were attached to a single unit. It seems to me that such a large number of wheels, or two or three nozzles to a single wheel, results in quite a complicated equipment, and ordinarily works out at very much greater cost than the Francis turbine construction. In the British Columbia plant I think the ratio of the bids mentioned by Mr. Henry to me was something like $43,000 for the tangential wheels against $29,000 for the Francis turbine.

A case in Mexico with which I had to do showed a ratio, considering both generator and wheels installed, of about two to one, that is, after looking into the problem of 6,000 h.p. units under an operating head of 670 feet—which I believe to be a higher head than had been adapted to Francis Turbines before that date—we found that when, taking into consideration the speed of the generators, the thirty-five-mile haul and the additional tonnage, it would cost us just about twice the amount of money to install tangential wheels that it would to install Francis turbines; and in that case we adopted the Francis turbines operating at 514 revolutions per minute.

It seems to me that the adoption of turbines for increasing heads will continue, and it won't be long before we will have turbines operating at, say, 1,000 feet head, providing the size of unit is in proportion so that a proper diameter of runners can be used. A unit comparable to a 1,000 foot head would probably be 12,000 or 15,000 h. p. or greater. The larger the unit for the higher head, the more favorable the conditions.

J. D. Galloway: In regard to the tests of the two units at Electra to which Mr. Homberger has called attention, it may be stated that these units are rated at 5,000 kw., being of the same design as the one originally purchased for De Sabla. It was intended to be a 4,000 kw. unit, but when placed in operation it developed that it would give 5,000 kw. without excessive heating, and since that time has been rated at that amount. Under tests this machine has given over 6,000 kw. It is well known that in designing a water wheel to operate such a machine the wheel is designed to have its most efficient point at the normal rating of the generator. This is true in the case of the wheels at Electra. They were supposed to be so designed that they were most efficient at 5,000 kw., and therefore had an overload capacity. Therefore, in the comparative test of which I spoke in my paper, the comparison was made not between wheels partially loaded as compared to those fully loaded, but rather the test was made at points somewhere near the most efficient condition of the wheels. For this reason the tests were comparative, and would indicate that the generator with two wheels was to a certain extent more efficient than the one with one wheel.

I was not present at those tests, but Mr. Baum told me in a general way that the tests all proved that the double wheel was probably a better machine.

In speaking of the De Sabla wheel, the jet was 6½ in. in diameter, and it was my intention to convey the idea that this jet was the highest power jet in use. It has been developed that larger sized jets are in use, diameter considered; but only comparative tests will ever tell where the most efficient diameter of jet lies. A number of other considerations relate to this subject, such as the speed of the generator. In obtaining data upon a 10,000 kw. generator it developed that a speed of 360 r.p.m. was about right.

Again, only a certain sized diameter of wheel can be shipped. For these reasons judgment must govern in deciding the size of the jet which may be used.

Referring to some points mentioned by Mr. Homberger. He is in error regarding the Necaxa wheels. They have two jets to one wheel. A description is given in the June, 1907 volume Transactions of the American Society of Civil Engineers.

The formula given by Mr. Arthur Adams for the economical design of pipes was not for water works pipes where loss of head cannot be translated into a value of power lost. Mr. Adams' formula, as given in the Transactions of the American Society of Civil Engineers, was worked out for power plant pipes lines. It is only an expression for that economical basis upon which all parts of a power plant can be designed, such as the transmission line, provided certain factors can be known. It is the difficulty in making the correct assumptions that makes judgment in selecting the size of pipe still the controlling factor.

Referring again to the proposed 36,000 h.p. turbine at Big Bend, Mr. Homberger says that loss of income in case of shutdown was probably the reason for rejection of the large unit. This was not the case. The plant now has four 18,000 h.p. units and a detailed study shows a sufficient amount of flexibility of the plant under load conditions as they are. It must be conceded that Mr. Hanscom understood these conditions when he suggested the large unit.

One word more regarding the question of pipes. The contract at Big Bend is not yet awarded, and pressure is being brought to bear to have different types of pipe adopted. The engineers of the Big Creek plant may feel confident that the lapwelded pipes are the best. All that I can say is that their troubles are ahead of them. I am speaking from the experience gained from troubles that are behind us.

Some criticism has been offered regarding the dates that are given in the paper. I would say that practically all of my historical information has been obtained from the pages of the Journal of Electricity, Power and Gas.

Geo. J. Henry, Jr.: I want to apologize to Mr. Galloway for not making myself clear in connection with the deflector that I sketched on the board. I did not for a moment intend to insinuate that he had not given me credit for the deflector; but what I was trying to show was not the deflector alone, but the deflector in connection with the automatic moving needle to effect water economy and accurate speed regulation. The device that I have shown on the board has been in operation I think now for over three years. With a 6,000-foot pipe line and a 1000-foot head, they were able to greatly increase the output of their plant, and maintained accurate speed regulation while economizing with water at the wheel with this device.

I have not tested a by-pass nozzle under identical conditions; but I have tested a by-pass nozzle under 360-foot head with a 2,600-foot pipe line, in which case the pressure rise was 15 per cent with one-half the load thrown off, as against not to exceed 5 per cent with the entire load off with the automatic nozzle mentioned under the much more severe conditions; and it was to bring out what I believe to be a

much more perfect piece of apparatus that I mentioned the deflector in connection with the automatic needle nozzle.

I would like to add a word or two to Mr. Hanscom's remarks in connection with the use of a tangential wheel equipment versus the Francis turbine.

I understood him to make the statement that the plant that Mr. Galloway mentioned—I don't remember Mr. Galloway mentioning the name, but Mr. Hanscom and I recognized the picture that was thrown on the screen, which showed four wheels on one shaft with 5,000 kw. generator, each of those wheels equipped with a double nozzle, meaning eight jets on four tangential wheels to drive one generator; and Mr. Hanscom stated that the cost of that equipment in comparison with a high-class Francis turbine was as about $29,000 for the turbine against $43,000 or $44,000 for the tangential wheel. Those figures I believe are correct. That is simply the first cost of the equipment. Let me add in that particular unit which is operating under 360-foot head at the plant of the Vancouver Power Company, the cost of the foundations and other incidental expenses were greatly to the disadvantage of the tangential wheel, largely increasing its installation cost over what it would have been for a turbine. In addition to that there is about 3 per cent of head lost; and further, there is a disadvantage of, I think I am conservative when I say, not less than 12½ per cent loss in efficiency when that unit is running the generator at normal load.

Those figures I give advisedly. I have investigated that particular case very thoroughly, and was concerned with the design of a good deal of their apparatus. I went up there and put on some automatic recording instruments and tested it thoroughly; and I know in that particular case the loss in first cost to the company was not less than $25,000 to $30,000 on each one of such units that they have put in, and 15 per cent of the horsepower capacity of the water is being lost continuously, compared to what could have been obtained and is being obtained in other plants with Francis turbines.

These power companies when making money and setting aside considerable surplus every year may not notice a thing like that; but the time will come when they will notice it, and they will have to sweep aside prejudices in favor of some one design and give consideration to other designs on more logical engineering lines if they want to get the best results from money invested.

Errata Note.—In the original paper by Mr. Galloway as published in this Journal of October 12, 1912, the sixth line from the top in the second column of Page 314 should read "thick at the bottom."

THE 1912 BOSTON ELECTRIC SHOW.

The 1912 Boston Electric Show, which is now being held, is attracting great attention, being one of the most elaborate and comprehensive electrified trade exhibits ever held. An elaborate street illumination has been prepared along the principal streets leading to the Mechanics' Building, whose exterior is illuminated with 30,000 incandescent lamps.

Beautiful interior effects have been secured by the use of fireproofed decorative materials, and by the lavish application of the brushes and paints of talented and high-priced artists. Grand Hall is typical of a substantial German village, the effect being borne out by the gallery construction and designs of the decorations for the exhibit booths on the main floor. The Electric Vehicle Section bears out the illusion of an open park, with its boulevards, trees, and beautiful park lighting effects. Machinery Hall bears out the illusion of a large factory, with its brick walls, open windows and ample illumination, characteristic of the electrically equipped manufacturing establishment. The galleries and broad halls of the second floor conform in their decorations to the character of the exhibits; the same is true of the large spaces in the basement.

In the basement is a first-class, completely equipped electric garage. Here the demonstration cars of the exhibitors will be kept, and provision has also been made for garaging the business cars the exhibitors are using.

A. I. E. E. DIRECTORS' MEETING.

The regular monthly meeting of the Board of Directors of the American Institute of Electrical Engineers was held in New York on Friday, October 11, 1912. A number of important matters were settled, including the adoption of a by-law that the appropriation of Institute funds for the meeting expenses shall not exceed a fund determined as follows:

(a) Fifty dollars for each Section independently of the number of members in the Section.

(b) One dollar and twenty-five cents for each Institute member residing within the territory of the Section at the beginning of the administrative year, August 1.

A resolution was adopted placing in the hands of the Secretary a fund sufficiently large to enable him to pay promptly upon receipt the expense vouchers of the Section secretaries covering the expenses of Section meetings, subject to ratification or adjustment later by the Finance Committee. Heretofore there has been some delay in the payment of these accounts, owing to the plan of holding the vouchers until approved by the Finance Committee, which meets but once each month.

The directors adopted the recommendation of the Badge Committee that the present form of badges for associates and members remain unchanged and that the form of badge for the grade of Fellow be the same size and shape as the Members badge, and identical in design, including the lettering, the only difference being that the Fellows badge shall be the reverse of the Members badge in color; namely, shall be blue lettering on a gold background.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

October 15.

The Tujunga Water & Power Company, of Los Angeles County, applied for authority to issue $300,000 of bonds, the proceeds to be used for construction of dams and for further development of water.

October 16.

A decision was rendered granting permission to the Southern Counties Gas Company, operating in Los Angeles and Orange Counties, to issue bonds in a sum not to exceed $47,000 as soon as the company had met the terms imposed in its mortgage. The mortgage requires that its earnings must reach one and one-half times its bond interest before the new bonds may be issued.

Permission was granted to the Great Western Power Company to purchase the North Sacramento Light & Water Company for $9000 and to assume obligations.

A decision was rendered granting permission to the Burbank Electric Light & Power Company to exercise franchise rights for the sale of electricity in Burbank, and also to issue 20,000 shares of stock to be sold at $10 per share to finance the construction.

October 18.

A decision was rendered granting the Pacific Electric Railway Company permission to issue $5,285,000 of bonds. The bonds are to be used to retire underlying securities of the Los Angeles Interurban Railway Company in the amount of $2,537,000; the Los Angeles & Redondo Railway Company in the amount of $500,000; and the Los Angeles & Redondo Railway Company in the amount of $2,248,000.

The Mountain Power Company applied for a certificate of public convenience and necessity to construct an electric plant in Crescent City and to operate in Del Norte County.

DISCUSSION UPON "GAS ENGINEERING IN AMERICAN UNIVERSITIES."

The President: Gentlemen, we are indeed indebted to Professor Sibley for this valuable paper that he has read us and for the information contained therein. I would be pleased to hear from Mr. E. C. Jones on the subject, and an expression of his opinion.

E. C. Jones: Mr. President, and members of the Association, Professor Sibley's paper is splendid. For a time I wondered if we were making a mistake in disintegrating the engineering profession into gas engineering, electrical engineering, civil engineering, and so on, instead of devoting our attention to integrating and making more of the engineer, making the title of engineer one of honor and so building up the ground work and giving the man the fundamentals by his college course so that when he graduates as an engineer it would be a simple matter for him to turn for his vocation to any branch of engineering. Gas engineering, of course, is special. In the past and at present in England, the gas engineer practically inherited his position. It is passed from father to son. In the old country the boy is parcelled out to a gas engineer. His father pays so much a year for five years for the privilege of having his son associated with a gas engineer and picking up the crumbs from his table in the gas business. We, in this country, are more liberal. We take the boys into our business. I love the boys and I would like to devote the last years of my life to helping young men get ahead in the gas business. We have among us many young men, and I want to say that I firmly believe in Californians. I was born and raised in Boston and I have many reasons to be proud of it. But during the last twenty-one years I have become a Californian and I am prouder of that. I love California. I believe in California's ways of doing things. I like the breadth of mind and wholesale way of doing things by both heart and head, and I am going to root for California as long as I have a breath in my body. (Applause).

I believe that the gas engineer of the future who takes our California money for making our California gas should be a Californian. I do not believe in imported articles any more. I think that we have the material here. Our climatic conditions and everything tend to the making of men in California, and the rest depends on the boy himself. Let us look about and find the timber, the raw material, among the boys of California, and let it be understood that the gas men of the future must be Californians—boys born and reared in this state and educated in this state, and let us members of the Pacific Coast Gas Association make their paths smooth towards success. We obligated ourselves, when we dug down for a hundred dollars or so. But that is not the end of our obligation. We are asking young men to adopt a vocation as we think in all seriousness, but have we stopped to think what is to become of the young man after he has devoted four years of his life to the attainment of the fundamentals in the university, to vacation periods in the gas works getting the practical side of it or, in other words, finding out what he wants to know when he returns for his fifth year at the university? And after he has graduated, after he is turned out of the university upon the completion of his fifth year, what are we going to do with that boy? There our obligation begins. It is not with the spending of our money. That is easy. Money often gets a man into trouble. But we as members of the Pacific Coast Gas Association must foster these young men and keep them out of trouble. We are responsible for their future. Stop and figure it. It is a very serious matter. It may be your boy or mine. We are responsible for the future of the boys now who listen to our promises and spend five years of their lives at the university. We must provide for them. And as the gas business of today is becoming boiled down to a few syndicates, large corporations, which include large numbers of smaller works, and the whole business is in the hands of a few men, it must depend on those few men to pick up this work that Professor Sibley is going to do at the university, and carry it forward. Not that we should take these young men and immediately make gas men of them; not that we should take these young men and burden them with a degree which would be the greatest handicap for a young man to take into a gas works to learn the business,—but we should say to these boys, "We will provide places for you, if not as cadet engineers, then as storekeepers, as office clerks in one department or another of our business, so that when we get to the real need of a man, a man to handle industrial gas appliances, for instance, we do not have to go east, we do not have to go anywhere, but we have the man ready at hand." We are not going to build gas engineers to take charge of great undertakings in California alone, because there are so few of them. We are not so well equipped with great undertakings here as they are in the east. There are more gas works in the little state of New York—and you could hide New York in one of our counties in California and lose it—than there are on the whole Pacific Coast. These young men are going to grow up and take our places and we are obligated to foster them, care for them, and see that they have places.

In regard to the degree of gas engineer, if it should be decided that it is advisable to so further disintegrate engineering as to have a degree of gas engineer, then it should come after long experience in the gas business on the part of these young men, and it should be the reward of merit after having succeeded in business, demonstrating this success to the satisfaction of their professors at the university upon their return to receive the degree, and demonstrating it to the public by their good works. Then maybe it is fitting to give these young men a degree of gas engineer, but not for a moment should we think of cheapening that degree or of giving that degree to an old line gas man who has struggled up from nothing, fought his way into the gas business and has made a living out of it. He should not have the honorary degree of gas engineer. Let us begin with fresh timber. Let us build our gas engineers and then, if they deserve it, let us give them the degree of gas engineer. Let us keep it high toned; make them work for it; and after they have gotten it, let them feel that they have something, and that the degree has not been cheapened by giving it to E. C. Jones or L. P. Lowe or somebody else to start the ball rolling. Give it a value which the man will place above everything else in his possession. And, gentlemen, in closing—you will pardon me; this is very close to my heart. I love the boys. The boys in my employ—and I have had three good fellows out of the mechanical engineering department of the University of California since the last commencement at California, in the gas works. Those boys get along much better than my own boys. They get more from me. I am more sympathetic with them. I suggest books for their reading and I try to make their work lighter than I would with my own boy.

In closing, I want to offer you a motto for this work that we are undertaking—the education of gas engineers—and ask you to take it home with you and think it over: "The finest success in life is to help another attain something that we have missed." (Applause.)

The President: Professor Cory, would you like to say something further on this subject?

Professor C. L. Cory: Thank you. A very little. We do not for one moment expect you to think that this is final. It is not. And by the discussion which I insist that we desire—and those of us who are most interested—and I need not mention President Wheeler—who is interested in this matter as much as in anything else in the University—would like to carry back any criticism or modification. And let me tell you that while I have the proper consideration for the ability of my associates, I will not have it misunderstood but what I prize much more highly the ability of the men in this Association in this particular matter. (Applause.)

Jno. D. Kuster: There is one thing that occurred to me in

listening to this paper, and that was the idea that the student would be expected to make up his mind before he entered college what he was going to do. In the experience that I have had, I think that students do not know, or very few of them do, until they are probably half through the course, and I was wondering why a course could not be arranged to take up about the first two years of ordinary work and then to fix him in the special lines in the next two years.

Professor Robert Sibley: In the program that we have outlined, the first two years are identical with our courses for general engineering students, whether mining, chemical, civil, mechanical, or electrical engineering. This course as here represented is the same as the mechanical and electrical students have at present at the University for the first two years. They do not begin to specialize except to take a little more chemistry which they would otherwise have as an elective study. When the student comes back at the end of the Junior year, he must make up his mind finally at that time. At that time he will probably be in shape to know from experience what he wants to do.

Henry C. Keyes: I have listened to this paper with a lot more interest than I have to any paper that has been written or read before any Association in the last fourteen years that I have been a member, and I do not see where we have one particle of criticism. I think the thing does not need any criticism. I have a son who graduated from Harvard—took the chemical course—and I am willing to say that in Harvard they do not have the facilities that they have in the University of California. The paper read by Professor Sibley is the completest that I have ever listened to in my life, and I hope there will not be any criticism. It does not need any criticism. I hope that the suggestions he has made will be followed out by this Association. And, in any financial aid that is necessary to carry this thing out, I know you can consider our Association will stand its share.

L. P. Lowe: I would like to ask Prof. Sibley if it would not be helpful for the University to have an experimental gas plant.

Professor Robert Sibley: It would be helpful, but I think it would be better if the plant were situated at some works nearby, where it would be possible for the students to go to and from. We would not suffer from having it off the campus. One of the ideas I had about this student work was that the student might spend a good deal of time, not around Berkeley nor around Oakland, but down here in Los Angeles, in special investigations. There should be a very intimate relationship between this Association and the University. The Association should work in conjunction with it. Let us know what the problems are and we will put these investigators to work.

Jno. D. Kuster: We have on this matter a permanent committee on engineering degree, and it appeals to me that it would be fitting that we should pass some motion showing our approval of this course outlined here by Professor Sibley, and instructing our engineering committee to make such arrangements as will put it into effect. I therefore make that as a motion.

The President: You have heard the motion.

Professor Cory: One other thing I wish to say. The University of California has expressed itself and really has shown its co-operation financially in this matter. We have a big financial problem there. But as long as Mr. Britton is as keenly identified with the finances of the University as he is, being a member of that committee, and as long as President Wheeler is interested as he is, you can rest assured that the financial problem will be met. We have the money to get just such an equipment as Mr. Jones speaks of. A reference of this matter, for such action as may be needed in the future, to your committee will be very, very fine for us who are working at it at the University.

L. P. Lowe: As a member of that committee, and on behalf of my fellow members, I would like to say that it seems to me that the matter might very well be left in the hands of the professors of the University from now on. I am very sure I will be glad to render any aid that I can.

Professor Cory: You will be called upon. Don't worry.

E. P. Lowe: It seems to me that the thing to now do is to get to work. Speaking for the committee, we will give all the assistance we can, but we are now "passing the buck." If the University will tell us what they wish us to do, it will be far better than for an inefficient committee of the Association to tell the University what it thinks it should do.

E. C. Jones: I believe that it is most important for us now to make up our minds to help in every way we can. But it is more important that we should not hinder these gentlemen. It is possible for us individually and as an Association to hinder them in their work. I believe we should have nothing to say about the selection of the timber. That will come naturally to the University of California, and the process of making a gas engineer will be by the process of elimination. If a man is not fitted to be a gas engineer, we will find it out and he will find it out after he has entered our employ. But let us help and not hinder. I do not believe we should place any handicap in the way of these gentlemen who are devoting themselves to this task.

F. H. Leach Jr.: May I ask if special lectures which are given in connection with the course will be open to special students? In other words, would any of the employes of the companies or members of this Association who are past that point where they could enter college or, perhaps, are not fitted to take up a college course, have the benefit of special lectures which may be given in the course?

Professor C. L. Cory: I can answer that by saying, Mr. President, that at the University not only are we glad to have anyone come in to any course at any time—because that is the way in which the work is done—as long as we have room for them, but I can assure you if anyone desires to go into any of the courses there, either directly as indicated here or indirectly as related to this work, the University will be most delighted to receive him. And, further, one point which I think has not been touched upon. A great many of you gentlemen here will not have the pleasure of being in the audience in the University, but you will find yourselves in the position of instructors at various times when you can spare us an hour or two to come over and give a real lecture by men who have really had experience, rather than to have students listen to us who have only had the opportunity to learn out of books.

Jno. D. Kuster: My motion was to put the stamp of approval on this paper and instruct our permanent committee on Gas Engineering Degree to work in harmony with the professors and faculty in putting this course immediately into effect.

Mr. Kuster's motion is thereupon put and unanimously carried.

NATIONAL JOVIAN CONVENTION.

As announced in these columns last week Frank E. Watts was elected Jupiter at the tenth annual convention of the Rejuvenated Sons of Jove at Pittsburgh, October 14-16. The other officers elected were: Mars, W. D. Shaler; Neptune, L. M. Cory; Pluto, A. W. Woodville; Hercules, H. A. Hart; Apollo, S. S. Montgomery; Avrenim, W. H. Vilett; Mercury, Eli C. Bennett; Vulcan, Chas. L. Martin.

On Tuesday there was a big parade, which was elaborately featured in the Pittsburgh newspapers. Particular credit and thanks is due to the electrical men of Pittsburgh for their cordial hospitality to all visitors.

With regards to holding the annual convention in San Francisco at the time of the Panama-Pacific Exposition in 1915, it was shown that the convention is always held at the home town of the Jupiter. Consequently, it will be necessary for a San Francisco man to be elected to this position at the 1914 meeting if the convention is to be hald at San Francisco in 1915.

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
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CONTENTS

One-Man Car Operation in Montana 353
Good Road Measures for Oregon 356
Use of Electric Power for Irrigation and Other Rural Purposes 357
Hydroelectric Power Plants in California 360
The 1912 Boston Electric Show 365
A. I. E. E. Directors' Meeting 365
News of California Railroad Commission 365
Discussion on "Gas Engineering in American Universities" 366
National Jovian Convention 367
Editorial 368
The Stability of Hydroelectric Securities.
The Municipal Telephone.
Growth of Foreign Electric Trade.
International Gas Congress.
Hydroelectric Design.
One-Man Prepayment Car.
Personals 370
Trade Notes 370
Meeting Notices 371
Chicago to Milwaukee on a Single Charge 371
New Catalogues 371
New Electrical Wiring Ordinance at Portland 372
Contractors 'Notes 372
Industrial 373
An Electric Harvester.
News Notes 374

The Stability of Hydroelectric Securities

During the past week public attention has again been directed to the stability and desirability of Western hydroelectric securities. The immediate occasion has been the emphatic denial by the officials of the Great Western Power Company of certain rumors that have been circulated to account for the cessation of work at the Big Meadows dam with the beginning of winter. However, regrettable may have been the effect of such stories on the stocks and bonds of this company, the widespread publicity of certain little known facts should be of great benefit to the industry in general.

Most significant is the statement that there is no hydroelectric security on the market today which has even been threatened with default. Considering the extreme youth of this important industry and the many ills to which childhood is heir, it augurs well for the early maturity of this class of investments. The day seems not far distant when hydroelectric issues will be on a par with those of the great railroads.

The Municipal Telephone

The city council of Seattle has recently appropriated a substantial fund for the use of the department of public utilities. This money is set aside to procure data necessary for the consideration of the construction and installation of a municipal telephone system. Other cities have in desperation, born of repeated inefficient service from the existing utility, under taken similar campaigns. Indeed, San Francisco and the bay region represent today such a state of affairs. Relief from poor service will not come so much from the competition of an installation built by the municipality as the necessary reduplication of equipment is costly. By forcing the utility itself, however, to give good and adequate service, the municipality takes advantage of its god-given rights. It is surprising that the citizens of San Francisco have now allowed many months to pass without bringing to a crucial test the illegal purchasing of the independent company's properties and franchises last winter. The inefficient service now administered since this removal of the former competitor, is indeed flagrantly apparent on all sides.

Growth of Foreign Electric Trade

The continued increase in demand for American-made electrical apparatus, especially among those countries bordering on the Pacific, is making itself felt in the commerce of the great nations of the world. A few years back Germany, for instance, practically corralled the entire import electrical supply for Chile, where large hydroelectric installations were being made. Today, in this South American republic, American manufacturers are getting a strong foothold, much to the discomfiture of the subjects of the Kaiser. This is only one instance of many that may be cited. So strongly is American influence being felt that the statistics recently issued by the British Foreign Office clearly indicate this trend in affairs electrical. In the year

1911, Germany exported a total valuation in electrical goods of $52,558,000, thus indicating no gain over 1910. Great Britain exported a total of $22,689,000, as opposed to $28,246,000 in 1910—a heavy loss in prestige. The United States on the other hand exported $19,329,000 in 1911 as opposed to $16,547,300 in 1910—an increase of about 20 per cent. American enterprise is thus shown to be firmly established in foreign quarters.

The increasing friendly relationship of western engineers and interests with the countries bordering on the Pacific will immensely heighten this foothold in the immediate future.

International Gas Congress

The announcement that E. C. Jones, official delegate from the Pacific Coast Gas Association, and the Panama-Pacific Exposition Company, has secured the hearty and enthusiastic support of the American Gas Institute for the holding of an international gas congress is indeed a subject for congratulation. The event is scheduled for September of 1915, at San Francisco, which is the month decided upon for the holding of the international electrical congress in that same city.

The meeting place is indeed appropriate. California, the cradle of the hydroelectric industry, together with its sister commonwealths, may well boast, not alone 70 per cent of possible potential water powers in the United States, but in actual development of the art, she may boast the highest standard of progress. Then, too, the continued increase in production and in highly scientific application of petroleum upon the Pacific Coast, demands a fair consideration as a near world leader in crude oil application and especially in one highly technical branch, that of oil gas manufacture.

Hydroelectric Design

A comprehensive symposium among men acquainted with the development of the hydroelectric art and design has long been a deep-felt need. The discussion found on another page of this issue, brought out by the recent paper of J. D. Galloway before the San Francisco Section of the American Institute of Electrical Engineers, is indeed important. Here are men who have made the West known the world over as a land where hydroelectric design reaches its highest development; men who have been the leading factors in bringing the hydraulic giant from the uncertain and inefficient tool of the early miner to the faithful, highly efficient impulse nozzle of today. Again, in this group are men that came upon mountain canyons laden with the steep-falling ditches and flumes of the "forty-niner" and have converted them into concrete lined canals and neatly cemented tunnels of present day practice. Add, then, to these two groups, the third who have assembled the equipment of the power house and wrought its efficient trim design and the symposium is complete.

It has been difficult in the past to find a comprehensive treatise on power plant design. The engineer who knows is, as a rule, a busy man. Such a man has scant time to put in writing what is taking place within his thinking consciousness. The contributions thus far, though others could contribute interestingly and profitably, nevertheless, present a working basis. They are in fact agreeable to the ancient Latin motto—non in summa sed in via—"not in the summit but on the way." Other contributors will certainly be welcomed by the editorial force of this journal and by the engineering fraternity at large.

One-Man Prepayment Car

Until the traveller has visited Montana and spent a winter among the beautiful mountain valleys of the Western portion of that great commonwealth he is liable to have, a mental picture of the climate there to be found wholly at variance with the true conditions. Western Montana, hemmed in by high mountains on all sides, thus affording to its fertile valleys a complete protection from the cold blasts of the Dakotas and the open portions of Canada to the north, presents features of seasonal beauty and wholesome ruggedness of climate in delightful proportions not to be found even in far-famed California, or in other portions of the Pacific Northwest. Such natural blessings, dawning upon the citizens of Missoula in 1900, caused a wide-spread realization of her importance to be crystallized into municipal growth with the result of a trebling in population by 1910. Along with this growth in population and in civic pride arose the yearning desire for an electric street railway. Viewed from every economic point, however, the enterprise could not be counted upon as a profitable one for years to come. Under the most favorable calculations, the utmost economy was seen to be necessary in operation of the proposed system if any return could be promised to the investor. The one-man prepayment car was decided upon as described elsewhere in this issue. Many were the forecastings as to the outcome. Today after three years of continuous operation the system stands as a monument of enterprise and ingenuity in this little city of Western civic pride.

The eminent humorist, Bob Burdette, once said that along a certain railroad crossing Indiana there were to be found ten universities and colleges and that there was an insane asylum situated at each end of the line. He ended by remarking that perhaps "the product of the means was equal to the product of the extremes." Be this as it may, the university student, due to his idealistic, and at the same time, "tom-foolery" make-up, is generally regarded as at least a fair test of the patience to transportation companies serving him. In Missoula, the railway system has three dead ends; one at the State University grounds, another at the U. S. Army post—Fort Missoula—and a third at one of the largest sawmill camps in the West. Any system serving the student, the common soldier and the lumber-jack, which after three years' operation returns a profitable ledger showing the handling of 2,500,000 patrons without a single serious accident, does indeed commend itself to the thoughtful consideration of other young and growing communities of the West.

PERSONALS.

R. C. Coffy has been appointed treasurer and auditor of the Tacoma Gas Company, replacing **R. F. Riseling**, resigned.

J. P. Downs, general superintendent of traffic of the Pacific Telephone and Telegraph Company, is at New York City on business.

H. A. Russell, sales manager for the General Electric Company at San Francisco, is on his way East to visit the factories at Schenectady and elsewhere.

Paul M. Goldrick, who was formerly connected with Fairbanks, Morse & Co., at Indianapolis, has taken a position in the San Francisco office of the Kellogg Switchboard and Supply Company.

Sidney Sprout, consulting engineer for the California-Oregon Power Company, returned during the week from the power site on the lower Klamath River, where a large dam is to be constructed.

Andrew N. Fox, advertising manager for the Benjamin Electric Company, and vice-president of the Chicago Advertising Association, is conducting a twenty weeks course in advertising for the Chicago Y. M. C. A.

R. B. Candage, formerly cashier of H. M. Byllesby & Company's Pacific Coast headquarters at Portland, Oregon, has been appointed auditor of the Western States Gas & Electric Company at Stockton, California, replacing **B. F. Wellington**, resigned.

E. B. Strong, president and general manager of this Journal, has been appointed Pacific Coast master of transportation for the 1913 convention of the National Electric Light Association, which will be held at Chicago probably during the first week of June.

P. H. Coolidge, general commercial superintendent of the Pacific Telephone and Telegraph Company, is at Los Angeles on business. **Charles F. Mason**, division commercial superintendent of the same company, with headquarters at Los Angeles, is a recent San Francisco visitor.

W. W. Briggs, assistant general sales manager of the Westinghouse Electric & Manufacturing Company, returned to San Francisco last Monday, after attending the sessions of the National Electric Railway Association at Chicago, and the annual Jovian Rejuvenation at Pittsburg.

Frank Hildreth of the Northern Idaho & Montana Power Company, Kalispell, Montana, has been appointed manager of the new business department of that company, succeeding **A. P. Tills**, who has gone to Eugene, Oregon, to assist Manager Jennings of the Oregon Power Company.

Geo. Dielman, manager of the new business department of the Tacoma Gas Company, has been appointed assistant manager of the Tacoma Gas Company, in charge of the Olympia plant. **H. H. Whiteside**, who has been temporarily filling the position at Olympia, has returned to the new business department at Tacoma.

E. C. Jones, gas engineer for the Pacific Gas & Electric Company, and delegate to the American Gas Institute from the Pacific Coast Gas Association, has secured the enthusiastic support of the American Gas Institute for an international gas congress during September of 1915 at the Panama-Pacific Exposition.

H. T. Edgar has been transferred from the management of the Seattle Division of the Puget Sound Traction, Light and Power Company to that of all the Stone & Webster properties at Houghton, Mich., Paducah, Ky., and the great hydroelectric plant being built at Keokuk, Iowa. His headquarters will be at Boston.

H. V. Carter, president of the Pacific States Electric Company, spent the past week in Sonoma and Mendocino Counties on the trade extension excursion tour of the San Francisco Chamber of Commerce. The various industries, such as the wine-making in Napa and Sonoma Counties, and the lumbering at Willits, were thoroughly investigated by the members of the party.

L. A. Somers has been made manager of the industrial and power department of the Pacific Coast district agency of the Westinghouse Electric & Manufacturing Company. This department has grown to be the most important employing about fifteen men. **W. P. L. Hommedieu**, of the same office, at San Francisco, will take charge of the railway and lighting department.

John Peirce, superintendent of the Mutual Telephone Company of Honolulu, passed through San Francisco during the week, en route from the Hawaiian Island to the Eastern States. An automatic telephone system is used in Honolulu, and Kellogg apparatus on the other islands of the group. The wireless telegraph business in the islands is controlled by this company. Mr. Peirce says that 42 per cent of his rural subscribers are Japanese.

TRADE NOTES.

H. Bittman, consulting engineer, White building, Seattle, who prepared the plans for the four transmission towers to be erected by the Olympic Power Company of Port Angeles, has awarded the contract for construction to the Vulcan Iron Works, Seattle. The towers will be of steel construction and will be as follows: Two 160 ft. in height and two 260 ft.

To provide for accommodation necessary by increase of staff, R. B. Elder has removed his quarters from the ground floor of the Rialto Building, San Francisco, to Rooms 503, 505, 509 and 511 same building, where the business of the Moloney Electric Company, of St. Louis, and The Ideal Electric and Manufacturing Company of Mansfield, Ohio, will be transacted. An interesting display of the products of these companies has been provided.

The General Electric Company has sold to the Northwestern Electric one 2000 kw. transformer, 38,000 v. / 66,000 v. Y., and 2300 v. low tension, 60 cycles, and also a switchboard. To the Crown Columbia Paper Company, Portland, Ore., three 2000 kw. transformers, rated same as above, and a switchboard. To the Standard American Dredging Company one 1000 h.p. 277 r.p.m, variable speed, continuous service, 2200 v. induction motor, with contactor control equipment for driving main suction pump on a dredge. Also, one 750 h.p. induction motor of the same type for the same service.

Among the orders secured for the Pelton Water Wheel Company by W. D. Ward, on his recent Northwestern tour, were two additional Pelton water wheels for the Britannia Mining and Smelting Company, making a total of six Pelton wheels that the above concern has installed and contracted for. The plant is located at Britannia Beach, near Vancouver, B. C. A contract was also closed with the British Columbia Sulphite Fiber Company for a Pelton water wheel to operate a paper mill on Howe Sound. Mr. Ward reports also the sale of water wheel equipment for use in the municipal electric power plant at Spillamachine, B. C.

The new Natomas Consolidated Dredge No. 8, which has just been built to replace the one that was destroyed by fire, will be the first gold dredge with a steel hull on the Pacific Coast. It is being equipped with Westinghouse electrical apparatus and will be in operation within 60 days. A novelty in the water drive of a gold dredge is a liquid rheostat. The electrodes are not lifted from the water, but a motor-driven pump rapidly raises or lowers the surface of the water in the tank of the rheostat. Owing to the loss by fire of the Hammon and the Natomas dredges, as extra precautions all of the oil switches on the new No. 8 will be enclosed in fireproof mteal compartments. The main switchboard in the pilot house will also be enclosed in a metal compartment.

MEETING NOTICES.

Engineering and Architectural Society of Portland.

The regular weekly luncheon of the Engineering and Architectural Societies of Portland was held at the Portland Hotel, on Tuesday, October 22d. An address was given by Hon. C. W. Fulton, ex-United States Senator, on the general subject of National Politics. Mr. A. C. McMicken, vice chairman of the Portland Section of National Electric Light Association, presided.

Energy Club.

Regular meetings of the Energy Club are held in Parlor A, Palace Hotel, San Francisco, at 12:15 on Wednesdays. All interested in power and machinery are invited to attend, there being no dues. On October 15 C. R. Wallis talked on "Street Illumination." On October 23 Geo. C. Pardee, ex-Governor of California delivered a masterly address on "Conservaion" and on October 30 B. A. Etcheverry will present a paper on "The Selection and Installation of A Small Pumping Plant."

Portland Electric Lunch Club.

Post cards for the weekly luncheons at the Hazelwood are now issued under the new title of the Electric Lunch Club, in the hopes that a great many men who are now receiving notices of the luncheons, and who are not Jovians, will feel free to come to the luncheons. On October 17 the speaker was A. M. Wilson of the Galena Signal Oil Company, Franklin, Pa., who gave us a talk on lubrication. Mr. Wilson's talk was very interesting and instructive, and was on a par with the rest of the talks which we have had before the club. On October 24 another meeting will be held.

Los Angeles Section A. I. E. E.

The Los Angeles Section of the American Institute of Electrical Engineers will meet on October 29, when J. E. MacDonald, secretary of the Joint Pole Committee, will speak on the "California Law on Overhead Crossings."

Seattle Section A. I. E. E.

The October meeting of the Seattle Section of the American Institute of Electrical Engineers was held Saturday evening, October 19, in the Assembly Hall, eighth floor of the Central Building. Dr. C. E. Magnusson, who has spent the past year on special electrical engineering and investigation work at Schenectady and other parts of the East, read a paper on "A Western Engineer in the East," giving a close insight into the very recent developments and methods in Eastern practice.

The executive committee has divided the membership into groups as listed below, and each group will be assigned one meeting during the coming year and will select the subject and furnish the paper thereon:

1.—Railway: A. A. Miller, Westinghouse Electric & Manufacturing Company, chairman; G. A. Richardson, Robert Howes, D. C. Barnes, A. M. Chitty, Chas. W. Reynolds, H. T. Edgar, L. R. Coffin.

2.—Transmission, Substations and Distribution: Glen Dunbar, City Lighting Plant, chairman; C. R. Collins, G. H. Smith, M. T. Crawford, B. B. Beckett T. C. Smith, W. E. Keeney, E. R. Nigh, R. A. Hopkins, F. A. Phipps, S. C. Lindsay, R. R. Easter, G. G. Gunderson, F. McKeen, L. E. Dickenson, A. Jacobson, Chas. Terrill, A. Shipeck, C. E. O'Tyson.

3.—Power Stations—Steam and Hydraulic: J. Harisberger, Puget Sound Traction, Light & Power Company, chairman; E. G. Allen, F. R. Bates, A. R. Haynes, T. W. Northrup, E. G. Robinson, O. N. Wiswell, J. M. Kinkaid, J. T. Heffernan, P. H. Ridgway, W. J. Santmeyer, J. F. Conway, G. E. Quinan, W. C. Butler, Henry Hull.

4.—Telephone and Telegraph, including Wireless Telegraphy: L. P. Crim, Pacific Telephone & Telegraph Company, chairman: C. H. Judson, H. F. Anderson, O. D. T. Brandt, E. C. Lange, P. D Naugle, H. W. Read, F. G. Simpson, O. C. Warner, R. E. Thatcher.

5.—Electrophysics: C. E. Magnusson, University of Washington, Chairman: A. E. Scow, J. D. Ross, T. L. Proctor, W. L. Hoffman, Elmer Dover, C. W. Colby, W. K. Akers, C. G. Worthington.

6.—Electric Lighting, including Interior Construction and Illumination: E. S. Code, Westinghouse Electric & Manufacturing Company, chairman; W. T. Batchellor, G. W. Cooley, Howard Joslyn, B. W. Collins, L. Evans, W. G. McKeen, D. P. Pierce, W. D. Shaw, B. O. Stare, A. W. Woodville, A. S. Wheeler.

7.—Industrial Power: W. S. Hoskins, Hoskins Machine Works, chairman; C. M. Bliven, E. J. Barry, T. S. Clark, W. H. Harold, W. A. Danielson, W. R. Hendrey, J. H. Hodgson, J. R. King, M. C. Lord, T. E. McMullen, W. M. Price, A. E. Ransom, J. L. Wright, R. J. Andrus.

Spokane Jovians.

At the regular meeting of the Spokane Jovian League on October 8, Condon R. Bean, local representative of John R. Roebling's Sons Company, was unanimously chosen as Statesman for the ensuing year and his name sent to headquarters with the request that he be appointed. V. G. Shinkle, who has so ably served as Statesman for the past year was not a candidate for re-election. H. G. Peterson of H. W. Johns-Manville Company, gave a splendid illustrated address on "Asbestos and Its Manufacture." A. L. Wright gave an address on "Electric Block Signal System," and after the luncheon the entire body took a trip as guests of The Washington Water Power Company on their interurban line and saw the actual workings of the block signal system, same being explanied and demonstrated by R. A. Willson, general superintendent of railway of The Washington Water Power Company.

CHICAGO TO MILWAUKEE ON A SINGLE CHARGE.

It is sometimes stated that electric cars are only adapted for short runs, and are not practical for bad roads. Although electrics are most frequently used for city and suburban services, yet the run recently made by a Borland-Grannis electric from Chicago to Milwaukee on a single charge of an "Exide" Battery proves that the electric car will give long mileage and can be satisfactorily operated under adverse weather and road conditions. The Borland electric car covered the 104 miles from Chicago to Milwaukee and for 54 miles of this distance the route was over muddy country roads, and the run was made during a pouring rain. The battery equipment consisted of a standard 40 cell Type 11 MV "Hycap-Exide" Battery, manufactured by The Electric Storage Battery Company.

NEW CATALOGUES.

The Technical Book Shop, Rialto Building, San Francisco, has issued a 32-page Descriptive Catalogue of Engineering Books which they carry in local stock.

The Crocker-Wheeler Company of Ampere, N. J., is distributing Bulletin Nos. 155-156, the former dealing with induction motors and the latter with motor-generator sets.

American Ever Ready Company have recently issued two new catalogues, one dealing with Portable Lights and Tungsten Batteries, the other with Christmas Tree Outfits for Decorative Lighting.

The Benjamin Electric Manufacturing Company is distributing a new catalogue B-20, on Wireless Clusters and Lighting Specialties. The publication which contains eighty pages is attractively arranged and profusely illustrated.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

NEW ELECTRICAL WIRING ORDINANCE AT PORTLAND.

On August 5th there went into effect in Portland, Oregon, a city ordinance regulating "Inside Electrical Construction."

This ordinance was formulated by a joint committee representing all the electrical interests in Portland, Oregon. Mr. F D. Weber, electrical inspector for the Underwriters' Equitable Rating Bureau, presided over this committee as chairman.

There has been about ninty contractors who have registered with the city electrical department. The electrical inspection department is a part of the city building department and is not an independent department. Therefore, this ordinance is an amendment to the Building Code for the City of Portland.

Section 1. That Section 767 of Ordinance No. 21455 of the City of Portland, entitled, "An Ordinance regulating the construction, erection, enlargement, raising, alteration, repair and use of buildings, and to provide for protection against fire and providing a penalty for the violation of the same," approved by the Mayor, June 24, 1910, be amended to read as follows:

Registration of Electrical Firms.

Section 767. Every person, firm or corporation engaged in conducting the business of placing or installing electrical wires, appliances or apparatus, or construction in or on buildings in the City of Portland, shall appear in person or by duly authorized representative at the office of the Department of Buildings and shall there register his name and place of business in said city and make affidavit that such name and place of business as thus registered are correctly stated, and thereupon shall be entitled to a certificate of registration from said department; provided, that no such certificate shall be granted for more than the period of one year or portion thereof unexpired.

It shall be unlawful for any person, firm or corporation to engage in conducting the business of placing, or installing electrical wire, appliances, apparatus, or construction in or on buildings in the City of Portland, without first obtaining a certificate of registration from the Department of Buildings, and said certificate must be renewed as herein provided for within thirty (30) days after the first day of January of each year.

Contractor's Bond to Be Furnished by Contractors.

Section 768. Every person, firm or corporation engaged in conducting the business of placing or installing electrical wires, appliances, apparatus or construction in or on buildings in the City of Portland, before registration, shall execute a bond to the city in the sum of five hundred ($500) dollars, with good and sufficient security for the faithful compliance with the provisions of this ordinance, and said bond shall be approved by the Mayor and filed with the City Auditor.

No Electrical Work to Be Done Without Permit.

Section 769. That all companies, firms, co-partnerships, corporations or persons (except public telephone, telegraph, fire alarm and messenger call companies operating under a regular franchise granted by the City of Portland and already under bonds to the City of Portland), who desire to have electric wiring, electric fixtures, appliances or apparatus installed in or on any building (except the installation of services wires and meters by the electric light and power service companies operating under franchise, and the installations in their power houses and sub-stations), shall procure a permit from the Department of Buildings. The term "electric wiring" herein used is intended to mean the installation of electric wire, fixtures, appliances or translation devices, or the addition to any wire, fixture, appliances or translation devices to be used in or on any building for the purpose of transmitting or translating electrical current for electric light, heat or power, lighting fixtures or installing electrical apparatus or translating devices of any nature, kind or description.

The Chief Inspector of Electricity, may, at any time, grant a permit for a temporary installation for a stipulated time, such times not to exceed thirty (30) days.

Fees for Permit.

Section 770. In order to procure a permit for the installation of electrical wiring the said companies, firms, co-partnerships, corporations or individuals shall, before having any electrical work commenced or any addition made to old wiring, make written application to the Department of Buildings, and shall pay the city treasurer, as a fee, the amount as required by the following schedule:

For electric light installation, for each outlet of 250 watts or less, where current is issued or controlled, 5 cents.

Outlets in excess of 250 watts shall be considered as one outlet for each 200 watts or fraction thereof, said outlet issues or controls.

For Power Installation.

For each unit, 25 cents, and an additional charge of ten (10) cents for each kilowatt or horsepower capacity or fraction thereof; horsepower being applied to motor installation and kilowatt to generator installations.

For installation, alteration or extension of new or old fixtures, same charge to be made per receptacle on fixtures as specified in the above schedule applying to outlets, except that when cord drops are hung in connection with exposed wiring of not more than three (3) drops, one permit may be issued for both outlets and cord drops without extra charge for said drops. The word "fixtures" as used above shall be construed to mean any receptacle for the reception of any electrical device. The term "cord drops" shall be construed to mean cord drops and sockets, or socket and receptacle alone. This does not apply to flush receptacles.

In estimating the cost of the permit, the same shall be taken to the nearest fifty (50) cents, and the minimum fee shall be fifty (50) cents.

Signs.

For each electric sign a rate of one ($1.00) dollar will be charged when the total number of lamps used does not exceed forty (40), and one ($1.00) dollar per hundred or part thereof in excess of forty (40) sockets.

Fees for Temporary Installation.

Inspection for temporary installation for show windows, exhibitions, conventions and the like shall be charged for at the rate of one ($1.00) dollar for the first forty (40) sockets, and fifty (50) cents per hundred thereafter in excess to forty (40) sockets.

For inspection of electrical apparatus for which no fee is herein prescribed a fee may be charged of not exceeding seventy-five (75) cents per hour for the time actually consumed by each inspector in making the inspection.

[To be continued.]

CONTRACTORS' NOTES.

The electrical construction work on the new Wigwam Theater, at Twenty-second and Mission streets, San Francisco, has been awarded to the Central Electric Company at $3500. Charles T. Phillips is the electrical engineer for the theater company.

INDUSTRIAL

AN ELECTRIC HARVESTER.

Harvesting of grain in California and farming practice in general has always differed somewhat from methods followed in the East. In the Eastern States, where summer showers are frequent, and even in some portions of California, it has been done by reapers or binders, which would allow the grain to cure while lying on the field for several days. In California the farmer has always allowed the wheat to become dead ripe and then cut it with a header. From the header it was formerly stacked or put direct through the thresher on the field. The next step was a traveling thresher, the whole outfit being propelled by horses and called a harvester. Latterly the horses have been replaced by the traction engine. The old-time method was therefore either binding the grain and putting it in shocks or else heading and stacking, or heading and threshing. Any one

Generator Mounted on Tractor and Motor on Thresher.

of these three methods requires for each threshing machine thirty or forty head of horses and nearly as many men, and the cost per acre for any of these methods is approximately $3.50,

C. L. Best Traction Company have developed an electric harvester which they state will cut the grain, thresh, reclean and put it in the sack ready for market at a cost of 80 cents per acre. The equipment comprises a six-cylinder gas traction engine which has mounted upon the rear of it a 20 kw. direct-current General Electric generator built specially for the work with a view of being enclosed like a street-car motor, as it must operate in dirty places much as a street-car motor has to do. This generator runs at 1200 r.p.m., 250 volt, and is shown in illustration mounted on the traction engine which is trailing the thresher. This picture also shows the motor mounted on the thresher having a pipe to deliver circulating air to the motor. This pipe is led above the machine in order to get clean air, the lower levels of air being too dirty for this purpose. It has a shaft extended forward and is driven by an endless belt from the flywheel of the gas engine. Upon this belt there is a spring-tightener that keeps it at an even tension.

Hitched to the tractor is a "C. L. B." combined harvester, which is a threshing machine on wheels with a header hinged to it and a recleaner built within the machine. This machine cuts, threshes and recleans the grain in one operation. The average amount of work one of these machines will do is approximately 2200 bushels per day of ten hours. The entire mechanism of this combined harvester, including the threshing cylinder, the various parts of the separating machinery, the header, the cutting mechanism, the conveying machinery, from header to recleaner, is run by a 25 h.p. motor, direct-coupled to the threshing cylinder, which in turn drives the belt and the machinery. The motor is the same general type as the generator, being enclosed, and is rated at 25 h.p., 950 r.p.m. The accompanying illustration shows the straw distributed in windrows over the field. This is an advantage over the old system that left the straw in stacks where it could not be plowed in or conveniently disposed of.

The advantage of the electric drive is a lessening of weight in the outfit. The old method of driving the threshing apparatus was through traction which was inefficient and

Tractor and Combined Harvester in Field.

expensive to produce. With the electric drive the power is transmitted from the main engine, or what we might call a portable central station, to the threshing machine by means of a cable. The motive power for operating the thresher is condensed in as little weight and as little space as possible.

This same traction engine in the fall and spring can be used for plowing, harrowing, drilling or discing any kind of land for about half what it can be done with horses, and where feed is high and scarce, much less than half.

The gas traction engine is 80 h.p. and six cylinder, has three speeds forward and reverse, all steel geared, spring mounted. The harvester has a 38 in. cylinder, 54 in. separator, 25 ft. to 35 ft. cut, 48 in. draper, 54 in. cleaner. It requires an engineer for the traction engine, a separator man for the harvester, header runner to adjust the header to various heights of the grain, and four sack sewers (two tenders and two sewers).

The Wall Street Journal of October 9, 1912, states that the Western Electric Company seems determined to make a record in the continuity and regularity of its monthly increase. July was 3 per cent ahead of the preceding July, August was the same percentage ahead of the same month in the preceding year and September now reports an increase of 4 per cent over September of 1911. The nine months so far reported show a gain of 3 per cent over the same period a year previous, so that it now appears that the company will run close to the early estimate of a gross business for 1912 of about $67,000,000.

NEWS NOTES

ILLUMINATION.

NEW WESTMINSTER, B. C.—The city council is seeking a site for a municipal gas plant for which $225,000 was voted last June.

IDAHO FALLS, IDAHO.—This place will vote November 19 on the question of issuing $35,000 in bonds for completing the hydroelectric plant.

WENATCHEE, WASH.—This place will soon vote on the question of issuing bonds in the sum of $6000 for cluster lights; $5000 for automobile fire apparatus and $4500 for installing a fire alarm system.

MORTON, WASH.—The Morton Electric Light Company, a subsidiary of the Metcalf Shingle Company, has petitioned the county commissioners of Lewis county for a franchise to furnish light and power to this place.

SHELTON, WASH.—Wickstrum & Company, engineers, Epler building, Seattle, have plans completed and are asking for figures to convert the plant of the Shelton Electric Company, Shelton, Wash., from coal to crude oil. The new equipment needed includes oil burners and pumps, a 500 barrel storage tank and 600 feet of 4-inch wooden pipe.

SANTA ANA, CAL.—Suit to enjoin the city of Newport Beach from selling bonds in the sum of $25,000 recently voted for a municipal lighting plant, has been filed in the superior court by C. H. L. Ghriest. The complaint asks the court to declare the bonds invalid and to make an order restraining the municipal government from issuing the securities.

GLENDALE, CAL.—The railroad commission has granted an order permitting the Pacific Light & Power Company to purchase the distributing system of the Glendale Light & Power Company for $5200. The Glendale Light & Power Company has been serving the city of Tropico. The Pacific Company made an offer, provided permission was given it to purchase the system of the Glendale Company of Tropico to reduce the rate on electric energy from 15c to 8c per kw. and to reduce the minimum charge from $1.50 to $1 per month. The company also offered to make all service connections free of charge, although the Glendale company has heretofore charged 20c for each connection. Provision is made in the order for the possible purchase by the city of Tropico of this plant.

STOCKTON, CAL.—The Oro Electric Corporation is soliciting contracts for domestic lighting at a graduated rate starting at 6½c per kw.-hr., preparatory to applying to the railroad commission for permission to compete in that municipality with the Western States Gas & Electric Company, which is now supplying that service for 7c per kw-hr. When the Oro Company makes its application the commission will institute at once an investigation of the reasonableness of the lower rate, to discover whether it is being offered merely so that the company may secure permission to enter the territory, or whether it will really result in a fair return on the property investment. The Oro corporation has given notice that the rate will stand, and will be defended as sufficient to bring in a proper return.

TRANSMISSION.

NYASSA, ORE.—R. W. Purdam of Nampa and associates, have recently surveyed the E. P. Bonnell power site and reservoir above Horseshoe Bend in Idaho. The object of the reservoir, aside from the establishment of a power plant, is to furnish water for an irrigation project near here comprising 30,000 acres of land.

FRESNO, CAL.—The San Joaquin Light & Power Company has entered into an agreement to erect a power line from Chowchilla, on the Southern Pacific, to the center of the tract which has been placed on the market for settlement by the United States Farm Land Company. There will be 108,000 acres in the sub-division, and the power line, which will be about ten miles in length, will furnish the motive power for pumping purposes.

REDDING, CAL.—Seven thousand pounds of machinery have been shipped from here by teams to the Mt. Shasta Power Company in the Big Bend of Pit River. The machinery comprises a portable power plant, including an air compressor that will furnish air for operating drills. The company is working a small force of men at each end of its proposed seven-mile tunnel. The Mt. Shasta will eventually develop 200,000 h.p. of electrical energy.

SAN FRANCISCO, CAL.—A four-year contract providing for the sale of power has been secured by the Northern California Power Company with the Oro Electric Corporation. Under the terms of the contract the Oro corporation is to take what power it needs to fill its requirements up to a maximum of 3000 kw. The power will come out of the Northern California's large surplus supply and will be transferred over high tension wires meeting below Hamilton.

DOWNIEVILLE, CAL.—The Marysville & Nevada Power Company, promoted by James O'Brien of Marysville, is advertising for bids for running a tunnel to divert the waters of the river at Goodyear Bar for the purpose of generating electricity. The water is to be taken through a point and dropped to the power house. A dam will be built next year to raise the water to the level of the tunnel. Jason M. Meen and John E. Ebert, both of Marysville, are associated with O'Brien in the enterprise, as is also James K. O'Brien.

BOISE, IDAHO.—The Great Shoshone & Twin Falls Power Company which recently was merged with the Idaho Consolidated Power Company and has plants at American Falls, Shoshone Falls and Salmon River, Idaho, is building a new concrete dam across the Snake River at American Falls, where a new generating station, with larger capacity, is being built. Work is being rushed on the concrete work night and day, and the plant is expected to be in operation by February 1, 1913. Power will be transmitted to Salt Lake City or Boise. Lines have already been laid to Shoshone and Mountain Home. It is reported that the Great Shoshone & Twin Falls Power Company has received an inquiry from Thos. A. Edison regarding a proposition to build a factory at Twin Falls for the manufacture of the new Edison Storage Battery.

SAN RAFAEL, CAL.—The Pacific Gas & Electric Company has recently entered into some important construction work that when completed will insure improvement of the company's electric service, not only in San Rafael but throughout the entire county of Marin. A new line has been started to run from the company's substation at Cordelia above Vallejo through San Rafael to Schuetzen Park, a distance of 34½ miles. The purpose of this is to supply the main feeder and insure permanent and uninterrupted service to the consumers of electricity for all purposes. Plans and estimates have been approved and the work is actually started. The new line is to be of the most modern equipment and will be a steel tower line throughout. It will take about 200 of these towers to support the wires that will carry the current. The towers will be 78 ft. in height, but besides this there will be needed a considerable number of higher ones ranging between 175 and 200 ft. in height for the purpose of crossing the various creeks and sloughs that lie between Cordelia and San Rafael. The contract has been let to the Duncanson-Harrelson Company of San Francisco.

PORTLAND, ORE.—The State Supreme Court of Washington has affirmed the right of the Northwestern Electric Company to condemn a power site at Lyle, Wash. The power, land and water rights originally were owned by Ham, Yearsley & Ryrie and George S. Canfield of Spokane. Messrs. Yearsley and Canfield succeeded to the interest when the firm was dissolved. The power properties were sold to the Northwestern Electric Company, a Washington and California corporation, the local men retaining the land and water rights. The right of the company to condemn land in Lyle townsite was at this juncture attacked by C. D. Keasey, and after the case was decided against Keasey in the Superior Court it was carried to the Supreme Court. According to Mr. Canfield, the electric company, which has been doing work in a small way, will at once proceed to develop 10,000 horsepower from their Klickitat River power plant. A total of 25,000 horsepower is available. This will be combined with power from a plant on the White Salmon River and taken to the City of Portland, where it will be used for light and power in competition with the present Portland Railway, Light & Power Company.

TRANSPORTATION.

EUGENE, ORE.—The advent of the Oregon Electric Railroad, connecting Portland with Eugene, was joyously celebrated on October 15.

LOS ANGELES, CAL.—Stockholders of the San Antonio & Rio Grande Valley Interurban Railway Company have authorized an issuance of bonds to amount of $10,000,000, proceeds of the issue to be used in the construction of about 250 miles of aditional road.

STOCKTON, CAL.—The railroad commission has amended its previous order granting to the Stockton Terminal & Eastern Railway company the right to issue bonds to the amount of $65,000. Under the original order this company was given the right merely to sell these bonds. The company desired to place the bonds as collateral for loans, and, in fact, had placed a portion of such bonds as collateral, thus unintentionally violating the original order. The amended order was made so that the company might issue these bonds as collateral and also validate the bonds which were already issued as collateral.

RICHMOND, CAL.—The Southern Pacific Company has completed all negotiations for the extension of its transbay electric service from Alameda and Berkeley to Richmond via the town of Albany, and all that now stands between the conclusion of these negotiations and the beginning of construction work is the approval of the State Railroad Commission. This was the information obtained by the commission Monday at a hearing of the railroad's application to purchase the Nichol street railway franchise in Richmond revealed that H. C. Cutting, who also enjoys a Richmond franchise, was acting as an agent of the Southern Pacific when he acquired it. Cutting's franchise provides for the right to construct a line that will extend from the termination of Nichol's franchise to the Richmond boundary line and from the boundary to Albany.

SACRAMENTO, CAL.—The State Railroad Commission has conducted a hearing into the application of Northern Electric Company for the issuance of $8,500,000 in bonds, the proceeds of which it is proposed to utilize for the taking over of the Vallejo & Northern Railroad and the completion of the extension from Vallejo to Sacramento. In response to a question asking the present value of the Northern Electric, one of the officials declared it was in the neighborhood of $7,500,000 in June of this year, but is now $10,000,000. The Commission endeavored to ascertain the reason for the increase in value, but the answer was amended so as to make the estimated valuation of the road between $8,000,000 and $10,000,000. Schindler revealed that it is proposed to use $6,500,000 of the proposed bond proceeds for construction work in extending the Vallejo & Northern to Sacramento. One point brought out was that with the new bond issue granted, the new road might be bonded for more than its worth, but the railroad's attorney explained that it was proposed to keep a fund of $1,000,000 on hand at all times to guarantee interest debt. If the application is granted the bonds will be issued in franc and pound sterling denominations, as the company has secured foreign capital for its work.

TELEPHONE AND TELEGRAPH.

RIALTO, CAL.—Bids will be received up to December 3 for a franchise to transmit electricity for telephone and telegraph purposes along public thoroughfares of this city.

VACAVILLE, CAL.—The petition of H. G. Brown and others asking for permission to erect and maintain a telephone line along certain public roads from Dixon to Maine Prairie has been granted.

MODESTO, CAL.—The petition of the Evans Telephone Company for permission to place and maintain poles and wires over and along the highways in the vicinity of Patterson, has been granted.

PORTLAND, ORE.—The Portland Young Men's Christian Association has completed the installation of one of the most modern wireless telegraphy plants in the west, and is going to form a club for the study and discussion of wireless.

LOS ANGELES, CAL.—The final decree in favor of the city of Pomona in the suit of the Sunset Telephone & Telegraph Company against the municipality has been signed by Federal Judge Wellborn. The suit decided in favor of the city of Pomona several months ago involved the right of a municipality to regulate corporations operating within its confines. Judge Wellborn heard the case originally. He favored the city of Pomona. The Sunset company carried the matter to the U. S. Circuit Court of Appeals, where Judge Wellborn was reversed. The city of Pomona then carried the litigation still higher and the U. S. Supreme Court in a decision rendered last April affirmed Judge Wellborn's ruling. The suit was of interest to all municipalities, and during its trial the court was packed with attorneys interested in the legal questions involved. The Sunset company was operating in Pomona without a franchise, and upon its refusal to secure such a license the city superintendent of streets was ordered by the councilmen to cut down the poles of the company. This action was stopped five days later by injunction proceedings. The case then tried out in the courts. Judge Wellborn received the mandate of the higher court to issue the final decree and allow the appellant costs of $826.92.

SAN FRANCISCO, CAL.—Arguments on the demurrer of the Pacific Telephone & Telegraph Company to the city's action for the dissolution of its consolidation with the Home Telephone Company, were heard before Judge John F. Ellison of Tehama County in extra sessions No. 1, of the superior court. Thomas E. Haven, on behalf of the city, argued at great length in an attempt to establish the doctrine that the franchise and the physical property of the Home concern were a single and inseparable legal entity, which could not at this time be separated. Calling attention to another provision of the Home company's franchise, Haven declared that the attempted merger between the two concerns was an attempted evasion of the city's right to collect 2 per cent of the Home company's net receipts. Attorney Thomas replied on behalf of the Pacific company. He could see no legal obstacle in the way of the sale of the Home's physical assets. What he thought would be legally impossible would be the separation of the company's tangible property from the use of that property. The Anglo-California Bank, trustee for the bondholders of the Home company, was represented by counsel. The case was submitted, with 30 days within which to file briefs and authorities.

ALPHABETICAL INDEX TO ADVERTISERS

Aluminum Company of America
American Bridge Company
Benjamin Electric Manufacturing Company
Blake Signal & Manufacturing Company
Bonestell & Company 5
Bridgeport Brass Company 4
Brill Company, The J. G.
Century Electric Company 3
Colonial Electric Company
Crocker-Wheeler Company
Cutler-Hammer Manufacturing Company 13
D. & W. Fuse Company
Dearborn Drug & Chemical Works 8
Electric Storage Battery Company
Fibre Conduit Company, The
Fort Wayne Electric Works 15
General Electric Company 16
Habirshaw Wire Company
Hemingray Glass Company 15
Hughes & Company, E. C. 8
Hunt, Mirk & Company
Indiana Rubber & Insulated Wire Company 11
Johns-Manville Company, H. W. 5
Klein & Sons, Mathias 18
Leahy Manufacturing Company 8
Locke Insulator Manufacturing Company 4
McGlauflin Manufacturing Company 8
Moloney Electric Co. 15
Moore & Company, Engineers, Chas. C.
Mueller & Company, R. S.
New York Insulated Wire Company
Northwestern Pacific Railways 11
Nuttall Company, R. D. 4
Ohio Brass Company
Okonite Company 18
Pacific States Electric Company 2
Pelton Water Wheel Company 5
Pierson, Roeding & Company 4
Pittsburg High Voltage Insulator Company, The 3
Pittsburg Piping & Equipment Company 18
Safety Insulated Wire & Cable Company 18
Schaw-Batcher Company Pipe Works, The
Simplex Electric Heating Company 15
Southern Pacific Company 17
Sprague Electric Works 5
Standard Underground Cable Company 18
Tracy Engineering Company 11
Thomas & Company, R. 1
Western Electric Company
Westinghouse Machine Company
Westinghouse Electric & Manufacturing Company 6
Weston Electrical Instrument Company 3

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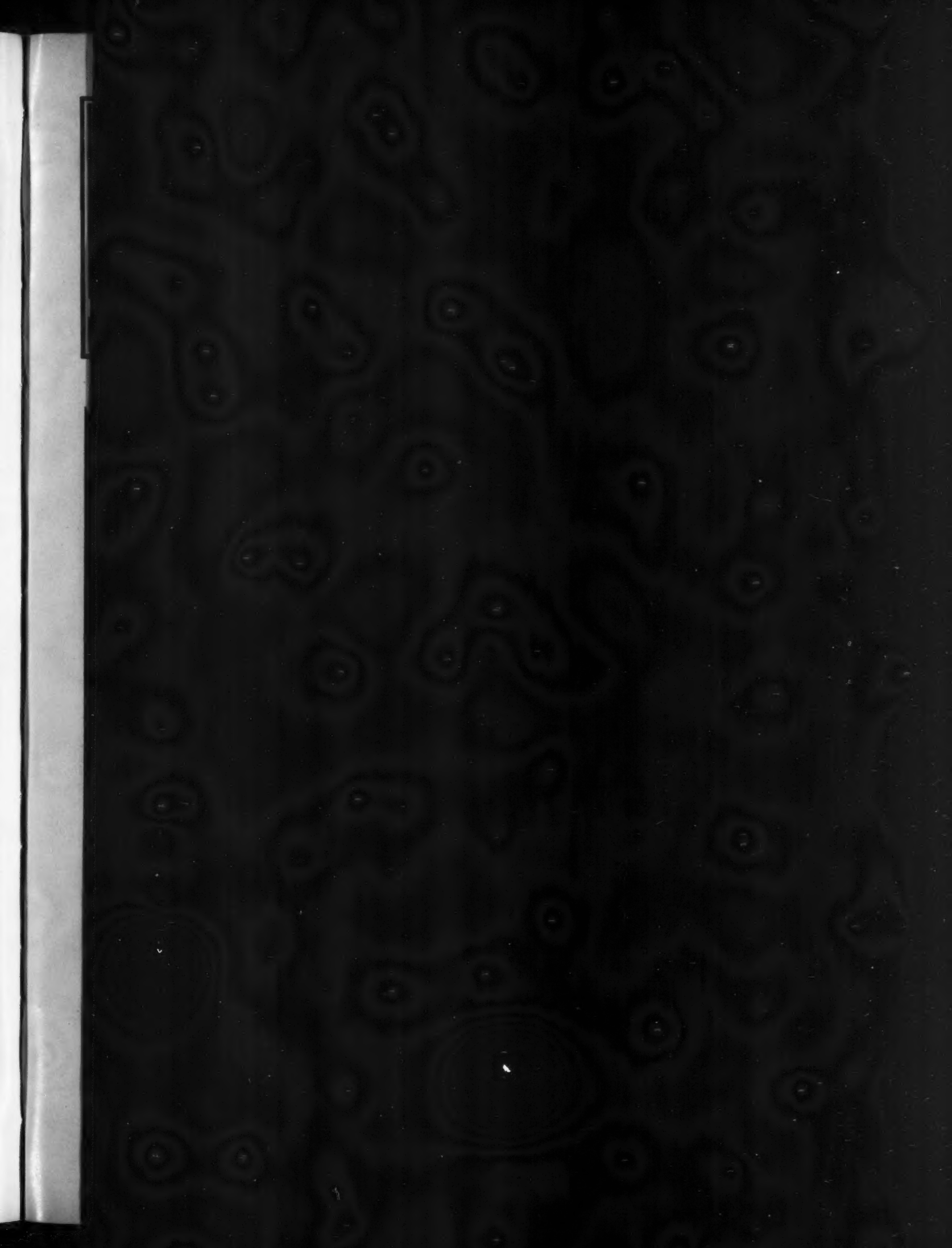
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